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1850.

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THE Author's design in this treatise is to exhibit, in a clear and concise manner, a set of rules in the several branches of Arithmetic, naturally arising out of each other; to furnish a more extensive collection of Practical Questions than are to be met with in any other work on the same subject; with such familiar illustrations and remarks as the learner generally requires of the teacher. These observations he has subjoined by way of Notes at the foot of the page; with what advantage, he must leave the reader to appreciate. The Questions, upwards of 3000 in number, may be thought more than necessary for quick, ingenious boys; but every judicious teacher will know how to proportion the number of questions to the capacities of his pupils; and the private student will work no longer in one rule than till he clearly understands it. The answers to the questions are not inserted in the work, but printed and sold separately by way of Key, a plan, the advantages of which will be obvious to every experienced teacher. Nearly all the questions being ORIGINAL, will prevent the learner from pirating answers out of other books; and it is presumed they are so varied as to prevent them from being worked mechanically and without consideration. At proper intervals are inserted PROMISCUOUS QUESTIONS in all the preceding rules, as well to prove that the pupil's progress is real, as to perfect him in what he has already learned. When a learner enters upon a new rule, it is necessary that the form and method of operation should be shown and explained to him in familiar terms. For this purpose, in the notes, under each rule is given one question worked at length, with such observations, it is hoped, as will be found very useful to the learner, and a convenience to the teacher.

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ARITHMETICAL TABLES.

NUMERATION.

Units	1
Tens	12
Hundreds	123
Thousands	1,234
Tens of Thousands	12,345
Hundreds of Thousands	123,456
Millions	1,234,567
Tens of Millions	12,345,678
Hundreds of Millions	123,456,789

PENCE.

d.		*s.*	*d*
20	are	1 .	8
24	—	2 .	0
30	—	2 .	6
36	—	3 .	0
40	—	3 .	4
48	—	4 .	0
50	—	4 .	2
60	—	5 .	0
70	—	5 .	10
72	—	6 .	0
80	—	6 .	8
84	—	7 .	0
90	—	7 .	6
96	—	8 .	0
100	—	8 .	4
108	—	9 .	0
110	—	9 .	2
120	—	10 .	0
130	—	10 .	10
132	—	11 .	0
140	—	11 .	8
144	—	12 .	0

SHILLINGS.

s.		£	*s.*
20	are	1 .	0
30	—	1 .	10
40	—	2 .	0
50	—	2 .	10
60	—	3 .	0
70	—	3 .	10
80	—	4 .	0
90	—	4 .	10
100	—	5 .	0
110	—	5 .	10
120	—	6 .	0
130	—	6 .	10
140	—	7 .	0
150	—	7 .	10
160	—	8 .	0
170	—	8 .	10
180	—	9 .	0
190	—	9 .	10
200	—	10 .	0
210	—	10 .	10
220	—	11 .	0
230	—	11 .	10

PRACTICE TABLES.

MONEY.

Of a Pound.

s.	*d.*	
10	0	are 1 half.
6	8	— 1 third.
5	0	— 1 fourth.
4	0	— 1 fifth.
3	4	— 1 sixth.
2	6	— 1 eighth.
2	0	— 1 tenth.
1	8	— 1 twelfth.
1	4	— 1 fifteenth.
1	3	— 1 sixteenth.
1	0	is 1 twentieth.

Of a Shilling.

d.		
6	are	1 half.
4	—	1 third.
3	—	1 fourth.
2	—	1 sixth.
1½	—	1 eighth.
1	is	1 twelfth.

Of a Penny.

q.		
2	are	1 half.
1	is	1 fourth.

AVOIRDUPOIS WEIGHT.

Of a Ton.

cwt.		
10	are	1 half.
5	—	1 fourth.

cwt.

4 are 1 fifth.
2½ — 1 eighth.
2 — 1 tenth.
1 is 1 twentieth.

Of a Cwt.

lb.		
56	are	1 half.
28	—	1 fourth.
16	—	1 seventh.
14	—	1 eighth.
8	—	1 fourteenth.

Of ½ Cwt. or 56lb.

lb.		
28	are	1 half.
14	—	1 fourth.
8	—	1 seventh.
7	—	1 eighth.
4	—	1 fourteenth.

Of a ¼ Cwt. or 28lb.

lb.		
14	are	1 half.
7	—	1 fourth.
4	—	1 seventh.
3½	—	1 eighth.

Of a Pound.

oz.		
8	are	1 half.
4	—	1 quarter.
2	—	1 eighth.

ADDITION AND SUBTRACTION TABLE.

1	2	3	4	5	6	7	8	9
2	4	5	6	7	8	9	10	11
3	5	6	7	8	9	10	11	12
4	6	7	8	9	10	11	12	13
5	7	8	9	10	11	12	13	14
6	8	9	10	11	12	13	14	15
7	9	10	11	12	13	14	15	16
8	10	11	12	13	14	15	16	17
9	11	12	13	14	15	16	17	18

MULTIPLICATION AND DIVISION TABLE.

1	2	3	4	5	6	7	8	9	10	11	12
2	4	6	8	10	12	14	16	18	20	22	24
3	6	9	12	15	18	21	24	27	30	33	36
4	8	12	16	20	24	28	32	36	40	44	48
5	10	15	20	25	30	35	40	45	50	55	60
6	12	18	24	30	36	42	48	54	60	66	72
7	14	21	28	35	42	49	56	63	70	77	84
8	16	24	32	40	48	56	64	72	80	88	96
9	18	27	36	45	54	63	72	81	90	99	108
10	20	30	40	50	60	70	80	90	100	110	120
11	22	33	44	55	66	77	88	99	110	121	132
12	24	36	48	60	72	84	96	108	120	132	144

TABLES OF IMPERIAL WEIGHTS AND MEASURES.

TROY WEIGHT.

24 grains	make	1 dwt.
20 dwts.	—	1 ounce.
12 ounces	—	1 pound.

APOTHECARIES' WEIGHT.

20 grains	make	1 scruple.
3 scruples	—	1 dram.
8 drams	—	1 ounce.
12 ounces	—	1 pound.

AVOIRDUPOIS WEIGHT.

16 drams	make	1 ounce.
16 ounces	—	1 pound.
28 pounds	—	1 quarter.
4 quarters	—	1 cwt.
20 cwt.	—	1 ton.

WOOL WEIGHT.

7 pounds	make	1 clove.
2 cloves	—	1 stone.
2 stone	—	1 tod.
$6\frac{1}{2}$ tod	—	1 wey.
2 weys	—	1 sack.
12 sacks	—	1 last.

CLOTH MEASURE.

$2\frac{1}{4}$ inches	make	1 nail.
4 nails	—	1 quarter.
3 quarters	—	1 Flemish ell.
4 quarters	—	1 yard.
5 quarters	—	1 English ell.
6 quarters	—	1 French ell.

LINEAL OR LONG MEASURE.

3 barleycorns	make	1 inch.
12 inches	—	1 foot.
3 feet	—	1 yard.
6 feet	—	1 fathom.
$5\frac{1}{2}$ yards	—	1 pole.
40 poles	—	1 furlong.
8 furlongs	—	1 mile.
3 miles	—	1 league.
$69\frac{1}{9}$ miles	—	1 degree.

SQUARE OR SUPERFICIAL MEASURE.

9 feet	make	1 yard.
$30\frac{1}{4}$ yards	—	1 pole.
40 poles	—	1 rood.
4 roods	—	1 acre.

CUBIC OR SOLID MEASURE.

1728 inches	make	1 solid foot.
27 feet	—	1 yard or load.

LIQUID MEASURE.

2 pints	make	1 quart.
4 quarts	—	1 gallon.
10 gallons	—	1 anker.
18 gallons	—	1 runlet.
42 gallons	—	1 tierce.
63 gallons	—	1 hogshead.
84 gallons	—	1 puncheon.
2 hogsheads	—	1 pipe.
2 pipes	—	1 tun.

ALE AND BEER MEASURE.

2 pints	make	1 quart.
4 quarts	—	1 gallon.
9 gallons	—	1 firkin.
2 firkins	—	1 kilderkin.
2 kilderkins	—	1 barrel.
$1\frac{1}{2}$ barrel	—	1 hogshead.
2 barrels	—	1 puncheon.
3 barrels	—	1 butt.

CORN AND DRY MEASURE.

2 pints	make	1 quart.
4 quarts	—	1 gallon.
2 gallons	—	1 peck.
4 pecks	—	1 bushel.
4 bushels	—	1 sack.
8 bushels	—	1 quarter.
5 quarters	—	1 wey.
2 weys	—	1 last.

COAL MEASURE.

4 pecks	make	1 bushel.
3 bushels	—	1 sack.
36 bushels	—	1 chaldron.

When sold by Weight.

1 sack	weighs	224 pounds.
10 sacks	weigh	1 ton.

MEASURE OF TIME.

60 seconds	make	1 minute.
60 minutes	—	1 hour.
24 hours	—	1 day.
7 days	—	1 week.
4 weeks	—	1 month.
365 days 6 hrs.	—	1 Julian year.

THE
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ASSISTANT.

NUMERATION.

NUMBER is a collection of many things of the same kind; or of many separate parts of the same thing.

By Numeration is meant the art of reading and writing figures according to their value.

The same figure, which, beginning at the right hand, expresses units, becomes ten times greater by each remove to the left. This will appear evident from an inspection of the following

TABLE:

6—UNITS,
6—Tens,
6—Hundreds,
6, 6—Thousands,
6—Tens of Thousands,
6—Hundreds of Thousands.

6; 6—MILLIONS,
6—Tens of *Millions*,
6—Hundreds of *Millions*,
6, 6—Thousands of *Millions*,
6—Tens of Thousands of *Millions*,
6—Hundreds of Thousands of *Millions*.

6; 6—BILLIONS,
6—Tens of *Billions*,
6—Hundreds of *Billions*,
6, 6—Thousands of *Billions*,
6—Tens of Thousands of *Billions*,
6—Hundreds of Thousands of *Billions*.

6; 6—TRILLIONS, &c., &c.

To numerate any sum, always begin at the right hand, and proceed towards the left.

The numeration of a question may be rendered more easy, by placing a comma after every third figure, beginning at the right hand and counting towards the left: by which means it will be divided into periods of three figures; excepting the last period, which will sometimes have less than three figures.

368	4
4367	40
78789	407
8063254	4070
997060543	04701
2076395780	407010
33047806985	4070103
654763207541	40701003
07543180955617	407010031
7789964103256386 7	4070100318
6320070548963019 34	
5496325780816354 96	
3 7 4 2 8 6 4 3 7 5 6 2 8 7 4 3 6 2 7 5 9	
4 2 0 0 3 8 0 1 0 0 3 7 0 0 1 4 0 0 3 2 0	
1 0 3 7 0 0 1 0 3 6 0 0 4 2 0 0 7 8 0 0 9	

The cipher, or 0, having no value, is used only to fill the place where no value is expressed, and remove others to places where they will denote the value required: thus, 396 is read, three hundred and ninety-six; but 30,960 is read, thirty thousand nine hundred and sixty.

SIMPLE ADDITION.

ADDITION is the putting of numbers together.—The sum or total is the amount of several numbers put together.

RULE.

Write units under units, tens under tens, &c.—Begin at the units' column, and add all the figures in it into one sum. Write down the units' figure of the sum, and carry the tens' figure to the next column; then add the number you carry and the next column into one sum, and write down the units' figure of that sum, and carry the tens as before. Thus do with every column, and write down the whole sum at the last. This will give the answer.

The following, as separate sums, may be added under the inspection of the teacher.

									6	7	8	7	8	9	6	7	8
4	5	6	5	3	4	4	3	5	3	6	9	6	7	7	5	8	7
3	2	3	4	5	6	5	4	6	3	5	5	5	6	3	6	5	8
5	3	4	3	8	4	4	3	4	4	7	7	4	2	8	6	2	9
4	4	4	5	4	5	5	5	3	5	5	6	3	5	7	7	6	6
3	5	5	4	4	5	2	4	3	6	6	9	7	7	5	5	7	7
2	4	3	2	5	3	3	3	6	4	2	5	6	8	8	7	8	5
4	4	6	3	5	6	5	5	5	2	7	8	7	5	7	3	7	7
5	3	5	4	2	5	3	4	6	6	4	7	6	6	2	6	5	6
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

	6	9	5	8	9	7	6	9	9	8	0
9	9	4	9	8	7	8	3	6	8	7	9
8	9	7	7	3	8	9	9	7	8	9	9
4	7	9	8	7	9	9	9	6	9	8	8
5	8	6	9	8	6	8	8	7	7	6	9
8	7	8	8	7	7	7	9	8	6	7	8
7	5	9	7	6	9	9	8	5	7	8	9
6	9	8	6	7	8	6	9	8	9	7	9
5	5	9	9	8	6	7	8	9	5	9	8

EXAMPLES.

(1)	(2)	(3)	(4)
237	3678	35978	473876
468	5281	64735	958293
593	7539	28674	847598
218	6284	93625	695724
746	9376	64738	328695
593	4267	67536	873569

(5) Add 468, 218, 593, 237, 746, 593, 738, and 695, together.
(6) Add 3746, 59368, 2743, 8074, 6709, 4590, 6283, 3428.
(7) Add 67356, 85294, 79084, 32579, 49287, 73695, 25673, 36473.
(8) Add 279364, 837095, 623706, 419670, 357290, 483674, 379682, 983746.
(9) Add 3426784, 4956739, 2735697, 4873694, 5930674, 8734260, 9630742, 8473659.
(10) Add 37462789, 53642905, 74386749, 12345678, 35746822, 14352678, 47158269, 58165273.

EXAMPLE.—Add 368, 746, 839, 705, together.

368	28
746	15
839	26
705	
2658	

Write the numbers one under another, as in the margin; units under units, tens under tens, &c. Begin at the units' column, and say 5 and 9 are 14, and 6 are 20, and 8 are 28; write down 8, and carry 2 to 0 are 2, and 3 are 5, and 4 are 9, and 6 are 15; write down 5, and carry 1 to 7 are 8, and 8 are 16, and 7 are 23, and 3 are 26, which written down are 2658 for the sum. You may begin at the top and add downwards, saying 8 and 6 are 14, and 9 are 23, and 5 are 28, &c.—Both methods being equally true, they will give the same sum, which may serve as a proof.

Add 3746, 28, 349, 18, together.

3746
28
349
18
4141

Take care that units stand under units, tens under tens, &c., so that the units' column will be full, and the vacancies fall on the left-hand side, as in the annexed example.—The reason for carrying the tens' figure will be evident, if you consider that its value cannot be expressed without removing it beyond the other figure by which it is removed to the next column, as will appear by writing both down.

(11) Add 4267, 6284, 5281, 9376, 7539, 3678, 2573, 9816.
(12) Add 64738, 28674, 35978, 67536, 93625, 647635, 28967, 56371.
(13) Add 328695, 847598, 473876, 873569, 695724, 958293, 367251, 632748.
(14) Add 5678, 9123, 4567, 8912, 3456, 7891, 2345, 6789, 1234, 7358.
(15) Add 67891, 23456, 78912, 34567, 89123, 45678, 91234, 56789, 12345, 75369.
(16) Add 738926, 549167, 389265, 491673, 892654, 916738, 926549, 167389, 265491, 673892.
(17) Add 2734506, 7265493, 2406851, 7593648, 4280715, 5719284, 8173062, 1826937, 372948, 43785.
(18) Add 345, 912, 678, 347, 289, 406, 839, 742, 362, 429, 647.
(19) Add 3467, 52736, 1234, 5678, 9123, 4567, 8912, 3456, 7891, 23456, 736.
(20) Add 30746, 82704, 6375, 84629, 63752, 87463, 91674, 32864, 96735, 47207, 36597.
(21) Add 372, 901, 468, 593, 729, 14, 685, 937, 290, 146, 859, 648.
(22) Add 5768, 9123, 4567, 8912, 3456, 7891, 2345, 6789, 1234, 7360, 2753, 2715.
(23) Add 34567, 89123, 45678, 91234, 56789, 12345, 67891, 23456, 78912, 36257, 49368, 73629.
(24) Add 372419, 627580, 340287, 657912, 162039, 837960, 740536, 259463, 135274, 864725, 731584, 42586.
(25) Add 234, 345, 456, 567, 678, 789, 891, 912, 123, 987, 876, 765, 654.
(26) Add 9876, 5432, 1987, 6543, 2198, 7654, 3219, 8765, 4321, 875, 468.
(27) Add 13579, 24681, 35792, 46813, 57924, 68, 135, 79246, 81357, 92468, 47693, 28560, 14068.
(28) Add 123, 345, 567, 789, 234, 456, 678, 912, 891, 216, 783, 309, 690, 128.
(29) Add 72814, 95637, 28149, 56372, 81495, 63728, 14956, 37281, 49563, 23785, 76214, 99738, 261, 428.
(30) Add 372814, 728149, 563728, 149563, 728149, 281495, 814956, 495637, 956372, 637281, 271850, 947318, 52681, 742638.
(31) Add 313, 726, 217, 879, 870, 10, 310, 354, 397, 823, 645, 243, 573, 721, 306, 28.
(32) Add 3728, 1964, 5372, 8196, 4537, 2819, 6453, 7281, 9645, 5469, 1827, 3546, 9182, 7354, 6918, 2735.
(33) Add 15263, 74891, 52637, 48915, 26374, 89152, 63748, 91526, 37489, 26374, 85912, 63748, 59126, 37485, 91263, 74859.
(34) Add 51782, 36147, 38371, 97223, 7964, 3621, 27123, 8345, 35921, 2374, 64223, 42354, 3560, 57578, 94587, 5693.

(35) Add 56341, 6228, 27305, 32415, 7856, 287, 4726, 2938, 100, 895, 528, 21732, 3526, 528, 3135, 838.

(36) Add 812113, 43721, 36847, 51487, 4926, 714653, 219774, 409259, 34281, 23841, 432645, 832761, 25515, 159293, 7872, 42142, 7243.

(37) Add 724136, 432147, 514867, 23748, 77238, 14726, 431252, 345752, 1527, 583746, 478615, 372549, 23167, 64231, 51241, 362314, 49435, 616792.

(38) Add 328345, 583746, 478615, 134127, 233712, 372549, 23167, 37421, 928057, 324675, 324675, 64231, 51241, 362314, 81046, 321859, 92364, 49435, 616792.

(39) Add 32841, 3548, 8977, 9542, 474148, 50144, 431, 463, 8071, 7112, 501709, 81743, 235, 255188, 3850, 7213, 838924, 27865.

(40) Add 357804, 489763, 719421, 653914, 827689, 836173, 271234, 325272, 658349, 396285, 714168, 523867, 819358, 312757, 284198, 453621, 531917, 747980.

SIMPLE SUBTRACTION.

SUBTRACTION is the taking of one number from another, by which we find their difference, or how much one number exceeds another.

The number obtained by subtraction, is called the remainder or difference.

RULE.

Write the less number below the greater; units under units, tens under tens, &c.

Begin at the units' figure, and take every lower figure from the higher. Where the higher number is too little, borrow ten and add it thereto, and for every ten so borrowed add one to the next lower figure.

PROOF.—Add the two lowest numbers together, that is, the remainder to the less given number; the sum will be the greater if the work be true.

EXAMPLES.

(1) From 36284506
Take 15928734
———
———

(2) From 104735264038
Take 67359846736
———————
———————

If you have occasion to borrow at the last figure, you are subtracting the greater from the less, which cannot be done.

Ciphers having no value in the last places, may be omitted, for 0039 is only 39.

To distinguish readily which of the two numbers is the greater, that which contains the greater number of figures is always the greater; and if they contain an equal number of figures, that which has the greatest left-hand figure, or the greatest figure nearest to the left hand, is the greatest number.

(3) Subtract 9472863 from 140592641.
(4) From 2307936584 subtract 91136537.
(5) Take 693752867 from 3147253678.
(6) From 35970462814 take 973842675.
(7) What is the difference between 35968 and 52873?
(8) What is the difference between 4902735 and 837596?
(9) How much does 3729568 exceed 1982873?
(10) How much is 428379604 less than 1047256781?
(11) Take 37946259738 from 1004728569362.
(12) If 372609346 be subtracted from 427350864, what will remain?
(13) What is the difference between 637928564 and 635768006?
(14) What is the difference between 173000640 and 4800037400?
(15) What number must be added to 360758, that the sum may be 628563?
(16) The sum of two numbers is 462583, and one of them is 239468, what is the other?
(17) Subtract 3040742685 from 10073069720.
(18) Subtract 73642856763 from 137428674207.
(19) From 1000473627859 subtract 999408742696.

EXAMPLE.—Subtract 2743 from 14285.

14285
2743
11542
14285

Having written the less number below the greater, units under units, tens under tens, &c., draw a line under both as in the margin: say, 3 from 5 and 2 remain, 4 from 8 and 4 remain, 7 from 2 I cannot, so I borrow 10 to 2 are 12, then 7 from 12 and 5 remain, (or you may subtract from the 10 borrowed and add the remainder to the higher figure, as 7 from 10 and 3 remain, which added to 2 are 5 for the whole remainder,) then for the 10 borrowed, I carry 1 to 2 make 3, and then 3 from 4 and 1 remains, 0 from 1 and 1 remains; so the whole remainder or difference is 11542, which added to 2743, the less given number, makes 14285, the greater, which proves the work.

1. The difference of two numbers added to the less will give the greater; or subtracted from the greater will leave the less.

Let 54 be one number, and 18 the other; then 36 the difference added to 18 the less, gives 54 the greater. Or, the difference 36 taken from 54 the greater, leaves 18 the less.

2. One of two numbers subtracted from their sum will leave the other.

Let 154 be the sum of two numbers, and let one of them be 67, required the other.

Take 67, one of the numbers, from 154 the sum, and you have 87, the other.

3. Two numbers, or the sum of two numbers, and their difference added together will make twice the greater.

Given two numbers, 25 and 33; their difference is 8: then 25, 33, and 8 added together make 66, that is, twice 33 the greater.

4. The difference of two numbers subtracted from their sum will leave twice the less.

Given two numbers, 45 and 72; their sum is 117, and difference 27, then 27 taken from 117 leaves 90, or twice 45 the less.

(20) From 1000837250 96 take 97342693.
(21) From 6735970462 59 take 30426389746.
(22) From 3746200840 7326 take 987463584.
(23) Take 420873658746 from 421369714325.
(24) Add 41827, 73659, 28149, 56372, 81495, 63728, 14956, 37281, 49563, 23785, 76214, 99738, 162, 824, and 83799, and subtract 76214 from the sum.
(25) Add 418273, 728149, 563728, 149563, 728149, 281495, 814956, 495637, 956372, 637281, 271850, 947318, 52681, and 836247, and subtract 813749 from the sum.
(26) How long is it since the year 1629?
(27) What was the year of our Lord 139 years ago?
(28) How old is that bond which was dated in the year 1695?
(29) In what year was that person born who is now 56 years old?
(30) Borrowed 567*l.* and paid again 395*l.*, how much remains unpaid?
(31) Add together 5067, 856, 60, 9058, 73, 6, 856, 596, 33, 8956, and 29, and subtract 5967 from the sum.
(32) Borrowed at different times 54*l.* 644*l.* 957*l.* 36*l.* 982*l.* 396*l.* 767*l.* 526*l.*, and paid again at different times 57*l.* 763*l.* 534*l.* 572*l.* 85*l.* 762*l.* 1000*l.* 589*l.*, what remains unpaid?
(33) John was born in the year 1817, and Thomas in 1809, what is the difference of their ages, and how old was each in 1846?
(34) Add 36251, 74891, 52637, 48915, 26374, 89152, 63748, 91526, 37489, 26374, 85192, 63748, 59126, 37485, 91623, and 95847, and subtract 29158 from the sum.
(35) Add 28715, 36147, 38371, 97223, 7964, 3621, 27123, 8345, 35021, 2374, 64223, 42354, 3560, 57578, 94587, and 3965, and subtract 38371 from the sum.
(36) Add 14365, 6228, 27305, 32415, 7856, 287, 4726, 2938, 100, 895, 528, 21732, 3526, 528, 3135, and 838, and subtract 23712 from the sum.
(37) Add 311218, 43731, 36847, 54487, 4926, 714653, 219974, 409259, 34281, 23841, 432645, 832761, 25515, 159293, 7872, 42142, and 3427, and subtract 392951, from the sum.
(38) Add 631427, 432147, 514867, 23748, 77238, 14726, 43122, 345752, 1527, 583746, 478615, 372549, 23167, 64231, 51941, 362314, 49354, and 297616, and subtract 51241, from the sum.
(39) Add 543823, 583746, 478615, 134127, 233712, 972549, 23167, 37421, 928057, 324675, 324675, 64231, 51241, 362314, 81046, 321859, 321859, 92364, 49435, and 297616, and subtract 923664 from the sum.
(40) Add 14823, 3548, 8977, 9542, 474148, 50144, 431, 463, 8071, 7112, 501709, 81743, 235, 255188, 3850, 7213, 838924, and 56872, and subtract 255188 from the sum.

(41) Add 408753, 489763, 716421, 653914, 827689, 836173, 271234, 325272, 658349, 396285, 714968, 523867, 819358, 312757, 284198, 453621, 531917, and 89747, and subtract 853918 from the sum.

SIMPLE MULTIPLICATION.

MULTIPLICATION is the finding how much any number amounts to by being repeated any given number of times; and this is done by the help of the following

Multiplication, Pence, and Shilling Table.

	l. s. d.	*l. s. d.*	*l. s. d.*	*l. s. d.*	*l. s. d.*	*l. s. d.*	*l. s. d.*	*l. s. d.*	*l. s. d.*	*l. s. d.*	*l. s. d.*
Pence	0.0.2	0.0.3	0.0.4	0.0.5	0.0.6	0.0.7	0.0.8	0.0.9	0.0.10	0.0.11	0.1.0
1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
Shills.	0.2.0	0.3.0	0.4.0	0.5.0	0.6.0	0.7.0	0.8.0	0.9.0	0.10.0	0.11.0	0.12.0
0.0.2	0.0 4	0.0.6	0.0.8	0.0.10	0.1.0	0.1.2	0.1.4	0.1.6	0.1.8	0.1.10	0.2.0
2	**4**	**6**	**8**	**10**	**12**	**14**	**16**	**18**	**20**	**22**	**24**
0.2.0	0.4.0	0.6.0	0.8.0	0.10.0	0.12.0	0.14.0	0.16.0	0.18.0	1.0.0	1.2.0	1.4.0
0.0.3	0.0.6	0.0.9	0.1.0	0.1.3	0.1.6	0.1.9	0.2.0	0.2.3	0.2.6	0.2.9	0.3.0
3	**6**	**9**	**12**	**15**	**18**	**21**	**24**	**27**	**30**	**33**	**36**
0.3.0	0 6.0	0.9.0	0.12.0	0.15.0	0.18.0	1.1.0	1.4.0	1.7.0	1.10.0	1.13.0	1.16.0
0.0.4	0.0.8	0.1.0	0.1.4	0.1.8	0.2.0	0.2.4	0.2.8	0.3.0	0.3.4	0.3.8	0.4.0
4	**8**	**12**	**16**	**20**	**24**	**28**	**32**	**36**	**40**	**44**	**48**
0.4.0	0.8.0	0.12.0	0.16.0	1.0.0	1.4.0	1.8.0	1.12.0	1.16.0	2.0.0	2.4.0	2.8.0
0.0.5	0.0.10	0.1.3	0.1.8	0.2.1	0.2 6	0.2.11	0.3.4	0.3.9	0.4.2	0.4.7	0.5.0
5	**10**	**15**	**20**	**25**	**30**	**35**	**40**	**45**	**50**	**55**	**60**
0.5.0	0.10.0	0.15.0	1.0.0	1.5.0	1.10.0	1.15.0	2.0.0	2.5.0	2.10.0	2.15.0	3.0.0
0.0.6	0.1.0	0.1.6	0.2.0	0.2.6	0.3.0	0.3.6	0.4.0	0.4.6	0.5.0	0.5.6	0.6.0
6	**12**	**18**	**24**	**30**	**36**	**42**	**48**	**54**	**60**	**66**	**72**
0.6.0	0.12.0	0.18.0	1.4.0	1.10.0	1.16.0	2.2.0	2.8.0	2.14.0	3.0.0	3.6.0	3.12.0
0.0.7	0.1.2	0.1.9	0.2.4	0.2.11	0.3.6	0.4.1	0.4 8	0.5.3	0.5.10	0.6.5	0.7.0
7	**14**	**21**	**28**	**35**	**42**	**49**	**56**	**63**	**70**	**77**	**84**
0.7.0	0.14.0	1.1.0	1.8.0	1.15.0	2.2.0	2.9.0	2.16.0	3.3.0	3.10.0	3.17.0	4.4.0
0.0.8	0.1.4	0.2.0	0.2.8	0.3.4	0.4.0	0.4.8	0.5.4	0.6.0	0.6.8	0.7.4	0.8.0
8	**16**	**24**	**32**	**40**	**48**	**56**	**64**	**72**	**80**	**88**	**96**
0.8.0	0.16.0	1.4.0	1.12.0	2.0.0	2.8.0	2.16.0	3.4.0	3.12.0	4.0.0	4.8.0	4.16.0
0.0.9	0.1.6	0.2.3	0.3.0	0.3.9	0.4.6	0.5.3	0.6.0	0.6.9	0.7.6	0.8.3	0.9.0
9	**18**	**27**	**36**	**45**	**54**	**63**	**72**	**81**	**90**	**99**	**108**
0.9.0	0.18.0	1.7.0	1.16.0	2.5.0	2.14.0	3.3.0	3.12.0	4.1.0	4.10.0	4.19.0	5.8.0
0.0.10	0.1.8	0.2.6	0.3.4	0.4.2	0.5.0	0.5.10	0.6.8	0.7.6	0.8.4	0.9.2	0.10.0
10	**20**	**30**	**40**	**50**	**60**	**70**	**80**	**90**	**100**	**110**	**120**
0.10.0	1.0.0	1.10.0	2.0.0	2.10.0	3.0.0	3.10.0	4.0.0	4.10.0	5.0.0	5.10.0	6.0.0
0.0.11	0.1.10	0.2.9	0.3.8	0.4.7	0.5.6	0.6.5	0.7.4	0.8.3	0.9.2	0.10.1	0.11.0
11	**22**	**33**	**44**	**55**	**66**	**77**	**88**	**99**	**110**	**121**	**132**
0.11.0	1.2.0	1.13.0	2.4.0	2.15.0	3.6.0	3.17.0	4.8.0	4.19.0	5.10.0	6.1.0	6.12.0
0.1.0	0.2.0	0.3.0	0.4.0	0.5.0	0.6.0	0.7.0	0.8.0	0.9.0	0.10.0	0.11.0	0.12.0
12	**24**	**36**	**48**	**60**	**72**	**84**	**96**	**108**	**120**	**132**	**144**
0.12.0	1.4.0	1.16.0	2.8.0	3.0.0	3.12.0	4.4.0	4.16.0	5.8.0	6.0.0	6.12.0	7.4.0

RULE.

First multiply the units' figure of the multiplicand; write down the units' figure of the product, and reserve the tens to be added to the second figure. Then multiply the second figure of the multiplicand, and to the product add the number reserved. Thus do with every figure of the multiplicand, and write down the whole sum at the last figure, this will give the answer required.

EXAMPLES.

(1) Multiply 372810645 By 2

Multiply 372819654 By 3

(2) Multiply 738475296 by 2, 3, 4, 5, 6, 7, 8, and 9.
(3) Multiply 1234567890 by 1, 2, 3, 4, 5, 6, 7, 8, and 9.
(4) Multiply 1426938507 by 2, 3, 4, 5, 6, 7, 8, 9, and 10.
(5) Multiply 593728416 by 2, 3, 4, 5, 6, 7, 8, and 9.
(6) Multiply 9518647362 by 2, 3, 4, 5, 6, 7, 8, and 9.

When the multiplier consists of several figures, multiply by each separately, and place the product under one another, so that the first figure of each product may be as far from units' place as the figure of the multiplier which produces it; add them in that position, and the sum will be the product required. (*a.*)

EXAMPLES.

(7) Multiply 379185246 By 23

Multiply 379185246 By 45

(8) Multiply 715296384 by 67, 89, 321, 476, and 895
(9) Multiply 37592684 by 476, 2531, 7468, and 3459
(10) Multiply 716258349 by 7849, 3526, and 2164.

EXAMPLE.—Multiply 864 by 7.

```
 864
   7
 ----
6048
```

Write the multiplier under the multiplicand, and draw a line under both, as in the margin; say, 7 times 4 are 28; write down 8 and carry 2; then 7 times 6 are 42, and 2 that is carried make 44; write down 4 and carry 4; then 7 times 8 are 56, and 4 that is carried make 60; write this down, and the whole product is 6048.

```
 287
 143
 ---
 861
1148
 287
 ---
41041
 ---
```

(*a*) When there are several figures in the multiplier, as in the annexed example, first multiply by the units' figure as before, then by the second figure of the multiplier, writing the first figure of its product in the second place; then by the third figure, writing its first figure in the third place: the sum of these products is the product required.

(11) Multiply 478369725 by 37952, 67405, and 718409.
(12) Multiply 128037906 by 4708605, and 390064080. (*b*)
(13) Multiply 786036970 by 781041600, and 6970060500.
(14) Multiply 39067400700 by 6973006000, and 428003900.
(15) Multiply 7968531402 by 475869, and 958647.
(16) Multiply 9876574023 by 859476, and 597684.
(17) Multiply 3021685947 by 467985, and 648975.
(18) Multiply 1672508493 by 589476, and 958457.
(19) Multiply 3040500602 by 4701020, and 120098030007.

If you can take two or more such numbers that their product will be the multiplier, and multiply by one of them, and that

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(*b*) When there are ciphers at the right of one or both factors, great care should be taken in placing the first right-hand figure of the multiplier under the first right-hand figure of the multiplicand, then proceed as before, neglecting the cipher or ciphers to the right as are in one or both of the given factors; then when the total product of these figures is obtained, place as many ciphers to the right of it as are in one or both factors for the true product. *Thus*,—to multiply 390720400 by 406000; having written the terms as are here annexed, and multiplied by the two significant figures, viz. 4 and 6 of the multiplier, to the sum of the two products, subjoin the five ciphers which are on the right hand of the two factors.

```
390720400
   406000
----------
 23443224
 15628816
----------
158632482400000
----------
```

The multiplicand may be changed into the multiplier, and the multiplier into the multiplicand, when it will render the work more commodious or convenient, for 9 times 4 are the same as 4 times 9.

All the contractions, &c., will be best understood by working examples both by them and the common method, and comparing the operations.

```
   734
   246
-------
  4404
  2936
  1468
-------
180564
-------
```

The true proof to multiplication is by division; but a presumptive proof is made by what is called casting out the nines, thus,—add all the figures in the multiplicand together, casting away 9 still as the sum amounts to that number, as 7 and 3 are 10, reject 9 and there remains 1, then 1 and 4 are 5, which write down in the cross; do the same with both multiplier and product; then multiply the remainder of the two factors together, and reject the nines in the product, and if this remainder be the same as that obtained from the product, the work is supposed to be true, otherwise it is false; for questions will always prove by this method when the work is true, and sometimes when it is false, for a different number may sometimes give the same remainder.

```
  6
5   3
  6
```

Multiply 273
By 17

4641

To multiply by two figures in one line when one of them is unity, multiply by the other figure, and to the product of every figure of the multiplicand add the right-hand figure thereof, if unity be the left-hand figure of the multiplier; but the left-hand figure of the multi-

product by another, and so on; the last product will be the same as if you had multiplied by the original multiplier. (*c*)

EXAMPLES.

(20) Multiply 37489 by 24, 28, 36, 49, and 63. (*c*)
(21) Multiply 72468 by 48, 108, 504, and 512.

SIMPLE DIVISION.

Division is the finding how often one number is contained in another.

The dividend is the number to be divided.

The divisor is the number to divide by.

The quotient is the number obtained by dividing, and is the number of times which the dividend contains the divisor.

The remainder is part of the dividend, which is sometimes left after the operation.

LONG DIVISION.

RULE.

Take the fewest figures of the dividend which will contain the divisor. Find how often the divisor is contained in these figures. Write the answer in the quotient, and multiply the divisor by it. Write the product under these assumed figures of the dividend, and subtract it from them. To the remainder annex the next figure of the dividend. Then ask how often the

---

Multiply 273 By 71 = 19383

234 by 99 = 23400 − 234 = 23166

plicand must be added to each product, when unity is the right-hand figure of the multiplier. In like manner you may add two figures, when you have two figures, both unity in the multiplier next to that you multiply by.

To multiply by any number of nines, you may annex as many ciphers to the multiplicand, and subtract the original multiplicand therefrom, the remainder will be the product required; for, annexing two ciphers is multiplying by 100, from which take one, there remains 99; so once the multiplicand taken from 100 times, the same multiplicand leaves 99 times the same.

To multiply by any number of threes, work as for nines, and one-third of the remainder will be the product required.

(*c*) To multiply first by one number, and that product by another, &c., is the same as to multiply by the product of those multipliers: for 7 times 9 are 63 times.

divisor is contained in that number as before. Thus proceed, till you have gone through all the figures of the dividend; what is then left will be a remainder.

PROOF.—Multiply the quotient and divisor one by the other, and add the remainder to the product; the sum will be the dividend if your work be true.

EXAMPLES.

	Divisor.	Dividend.	Quotient.
(1)	7)	462873 (.	; 4) 697358 (. . . . . ;

(2) Divide 73692785 by 2, 3, 4, 5, 6, 7, 8, and 9.
(3) Divide 279365784 by 8, 9, 3, 4, 5, and 6.
(4) Divide 392876459 by 2, 7, 8, 9, and 10.

EXAMPLES.—Divide 2673 by 7.

7)2673(381$\frac{6}{7}$
21 7
57 2673
56
13
7
6

Write the divisor and dividend as in the example, and because 26 are the fewest figures that will contain 7, say how often 7 in 26? answer, 3 times; write 3 in the quotient; then 3 times 7 is 21, which write under 26, and subtract, there remains 5, to which annex 7, the next figure of the dividend, make 57; then 7 in 57, 8 times; write 8 in the quotient, and 8 times is 56, which write under 57, and subtract: to 1 the remainder annex the next figure of the dividend 3, and say how often 7 in 13? answer 1, which write also in the quotient; and once 7 is 7, which subtract from 13 leaves 6 for the remainder, and the work is done, because there are no more figures in the dividend; the quotient is 381, which, multiplied by 7 the divisor, and the remainder added to the product, make 2673 the dividend, which proves the work.

674)28734(42
2696
1774
1348
426

In order to discover how often one number is contained in another, see how often the left-hand figure of the one is contained in the left-hand figure of the other, or in the two left-hand figures of the other, if it has a figure more than the first, and consider the increase that will arise by carrying; as how often 674 in 2873, here I say how often 6 in 28, say 4 times, and I see there will be 2 to carry, so that 4 times 6 is 24, and 2 makes 26, which is the nearest; and so of any other.

Take care that when you have multiplied, the product be not greater than the number to be subtracted from; for if it be, the quotient figure is too great.

If the remainder, after subtracting, be as much as the divisor, the quotient figure is too little.

Sometimes, when the next figure of the dividend is annexed to the remainder, it will not still contain the divisor; in such case write a cipher in the quotient, then annex another figure, for you must put a figure in the quotient for every figure you take in the dividend after you have written the first figure in the quotient.

(5) Divide 463725638 by 3, 4, 6, 2, 9, 5, and 8.
(6) Divide 246375096 by 10, 11, 12, 24, 36, and 42.
(7) Divide 246375096 by 54, 68, 84, and 95.
(8) Divide 742869730 by 78, 49, 63, 58, and 178.
(9) Divide 328967142 by 63, 38, 59, 84, and 69.
(10) Divide 128374268 by 124, 238, 349, and 672.
(11) Divide 7362597004 by 924, 296, 789, and 374.
(12) Divide 462735968 by 1284, 2387, and 6749.
(13) Divide 37428674593 by 38479, and 72846.
(14) Divide 743287369470 by 87025, and 67438.
(15) Divide 28073584697 by 492867 and 736970.
(16) Divide 730628749365 by 473625 and 674800.

SHORT DIVISION.

When your divisor does not exceed the number 12, you may keep the work in memory, and write down only the quotient figures. (*a*)

EXAMPLES.

(17) Divide 73846975 by 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, and 12.
(18) Divide 3742675967 by 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, and 12.

If there be ciphers on the right hand of such divisor, you may cut them off, and as many figures from the right hand of the dividend; then divide as if both were wanting; only the figures which were cut from the dividend must be annexed to the remainder for the whole remainder complete. (*b*)

(19) Divide 7240867 43 by 10, 20, 30, 40, 50, 60, 70, 80, and 90.
(20) Divide 3273647956 by 100, 120, 300, 400, and 700.

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7)374
——
$53\frac{3}{7}$
——

(*a*) Short division is exactly the same with long division, except that you write down only the quotient figures. Thus, how often 7 in 37? answer 5 times, which write down below the line; then 5 times 7 are 35, which taken from 37 leaves 2, to which take 4 which makes 24; how often 7 in 24? answer 3 times, which write down; 3 times 7 are 21, which taken from 24 leaves 3 for the remainder, and the quotient is $53\frac{3}{7}$.

4,00)274,36
————
$68\frac{236}{400}$
————

(*b*) Here because the two right-hand figures of the divisor are ciphers, I cut them off, and two figures from the right hand of the dividend; so then I have but 274 to divide by 4, which gives 68 for the quotient, to the remainder 2 annex 36 which was cut from the dividend, makes 236 for the whole remainder.

When the divisor is the product of two or more small numbers within the limits of the Multiplication Table. (See Table of Composite Numbers, pages 49 *and* 50.*)*

Rule. Divide the dividend by each of the component parts separately for the required quotient. If there be only two divisors, and a remainder to each, multiply the first divisor by the second remainder, and to that product add the first remainder for the true one. Should there be three divisors and a remainder to the third quotient, multiply the first and second divisors by the third remainder, and if four divisors and a remainder to the fourth quotient, multiply the three first divisors by the fourth remainder, and so on with others; these products added into one sum will give the true remainder. (*c*)

Note. This rule will be found very convenient in facilitating the operation, if the dividend contain a great number of figures, and the divisor being a composite number.

(21) Divide 3748699364 by 24, 36, 48, 56, and 72.

(22) Divide 2347628736 by 25, 42, 280, 81, and 360.

To multiply by a fraction.—Multiply by the numerator, and divide the product by the denominator. (*d*)

(23) Multiply 3648 by $\frac{2}{3}$, $\frac{3}{4}$, $\frac{1}{2}$, $\frac{7}{8}$, $\frac{1}{4}$, $\frac{1}{6}$, $\frac{5}{9}$, $\frac{7}{12}$, and $\frac{3}{16}$.

(*c*) Divide 6944568393808506 by 9856, or 11 . 8 . 7 . 4 . 4.

11)6944568393808506

8)631324399437136....10.....= 10

7)78915549929642.... 0.....= 0

4)11273649989948.... 6×11×8 .....= 528

4)2818412497487.... 0.....= 0

Quotient = 704603124371.... 3×11×8×7×4 = 7392

Remainder = 7930

∴ *The Answer* = $704603124371\frac{7930}{9856}$

(*d*) A fraction is a broken number expressed by two numbers written one above the other, with a small line drawn betwixt, as $\frac{3}{4}$; the lower number is called the denominator, and the higher number the

To multiply by a whole number and a fraction.—Multiply by the fraction as before, and then by the whole number, writing the product directly under the former; add them together, and the sum will be the product required. (*e*)

(24) Multiply 327 by $3\frac{1}{4}$, $5\frac{1}{2}$, $6\frac{7}{8}$, $24\frac{3}{5}$, $48\frac{7}{8}$, and $1\frac{5}{9}$.

PROMISCUOUS QUESTIONS.

(1) Add 3746, 248, 93, 6274, 84, 298, and 87 together.
(2) What is the sum of 79 and 84?
(3) What is the difference between 168 and 723?
(4) What is the product of 284 and 39?
(5) What is the quotient of 3864 by 83?
(6) Required the sum, difference, product, and quotient of 1824 and 76.
(7) What number must be added to 37846, that the sum may be 120970?
(8) Add 457805, 7654, 1780767, and 178, subtract 76542 from the sum, and multiply the remainder by 987.
(9) Find the difference between 196784 and 209476, multiply it by 7065, and divide the product by 657.

---

numerator; the value is understood to be the numerator divided by the denominator: 7 numerator, 8 denominator, is 7-eighths, or 7 divided by 8.

Multiply 246 by $\frac{5}{8}$. Multiply by 5 the numerator, and divide the product by 8 the denominator, the quotient $153\frac{6}{8}$ is the product required.

```
 246
   5
-------
8)1230
-------
 153 6/8
-------
```

(*e*) Multiply 282 By $7\frac{3}{4}$. Multiply by $\frac{3}{4}$ as before, then by 7 as in common multiplication, writing the product directly under the former, the sum $2185\frac{2}{4}$ is the product required.

```
      4)846
      -----
      211 2/4
      1974
      -----
      2185 2/4
      -----
```

(10) Multiply 97065 by 70508, add 47067 to the product, and subtract 1978576.
(11) Divide 530208 by 789, multiply the quotient by 897, and subtract 67057.
(12) Find the sum of 79678, 57062, 1598, 9796, 78, 88, and multiply it by 9786.
(13) Find the difference between 3078567 and 3075768, and add 489 times 6978.
(14) Divide the product of 9876 and 95887 by 789.
(15) Multiply 9987605 by 704048, and divide the product by 76859, also by 89678.

Questions to exercise the foregoing Rules.

(1) How much are 35, 72, 49, 53, 113, 95, 13*s.* 4*d.* 87, 33, 45, 10, 57, 83, 99, 101, 111, 37, 47, 21, 59, 67, 5, 89, 65, 93, 77, 6*s.* 8*d.* 94, 51 *shillings?*
(2) How much are 15, 17, 19, 21, 23, 27, 29, 35, 31, 33, 37, 41, 43, 38, 44, 78, 47, 51, 22, 53, 55, 86, 58, 62, 64, 67, 69, 71, 73, 65, 75, 79, 49, 82, 76, 85, 45, 88, 112, 91, 101, 93, 131, 95, 122, 97, 115, 99, *pence?*
(3) How much are 5, 7, 6, 9, 11, 10, 8, 13, 12, 16, 19, 15, 21, 18, 17, 20, 22, 14, 23 *farthings?*
(4) How much are 28*lbs.* 20*dwts.* 20*grs.* 112*lbs.* 12*oz.* 3*sc.* 16*drs.* 24*grs.* 30*lbs.* 14*lbs.* 8*drs.* 19½*cwt.* 20*cwt.* 120*lbs.* 4*qrs.* 16*lbs.?*
(5) How much are 4*qrs.* 3*ft.* 5½*yds.* 3*qrs.* 12*in.* 20*lea.* 4 *roods,* 4*in.* 40 *poles,* 3*b.c.* 6*qrs.* 8*fur.* 3 *miles,* 2 *yds.* 60 *miles,* 5*qrs.* 4*in.* 2¼*in.* 69½ *miles?*
(6) How much are 4*qts.* 8*qts.* 63*gal.* 7½*lbs.* 8*bush.* 36*gal.* 2 *gills,* 42*gal.* 9*gal.* 4*pks.* 36*bush.* 18*gal.* 126*gal.* 48*gal.* 32*qts.* 54*gal.* 10*gal.* 16*gal.* 84*gal.* 2*pts.* 8*gal.* 32*pks.* 3*bush.* 2*kil.* 2*hhds.?*
(7) How much are 4*wks.* 60*sec.* 13*mo.* 7 *days,* 60*min.* 365 *days,* 24 *hours,* 12*mo.* 28 *days,* 31 *days,* 30 *days,* 29 *days?*
(8) How much are 24 *sheets,* 12*doz.* 20*qrs.* 2*reams?*

To exercise Numeration.

576, 8976, 905, 57957, 4594, 900567, 7004, 80504, 756004. 811040, 9010104, 985767525, 7120095 76, 101101210. 200105004, 2900159604, 4000561004, 3710045706, 211900054. 90167401247 92

EXPLANATION OF THE CHARACTERS USED IN ARITHMETIC, &c.

$+$ denotes *plus*, or *more*. The sign of *addition*, signifying that the numbers between which it is placed are to be added together. Thus, $9+6$ denotes that 6 is to be added to 9. In geometrical lines, also, AB + CD signifies that the line AB is to be increased to the line CD. Also $a+b$ denotes the sum of the quantities represented by a and b.

$-$ denotes *minus*, or *less*. The sign of *subtraction*, signifying that the latter of the two numbers between which it is placed is to be taken from the former. Thus $5-3$ denotes that the 3 is to be taken from the 5. In geometrical lines, also, AB—CD signifies that the line CD is to be taken from the line AB. Otherwise $a-b$ denotes their difference when b is the less, and $b-a$ shows their difference when a is the less.

$\sim$ denotes *difference;* and is written between two numbers or quantities to denote their difference, when it does not appear which of them is the greater; as $\frac{13}{17} \sim \frac{91}{103}$, or $a \sim b$.

$\times$ or $\cdot$ denotes *into*, or *by*. The sign of *multiplication*, signifying that the numbers between which it is placed are to be multiplied together. Thus 8×6 denotes that 8 is to be multiplied by 6. In geometrical lines, also, AB × CD, or is expressed thus, AB . CD, and signifies that the line AB is to be multiplied by the line CD, or the rectangle formed by the lines AB and CD. Again, $a \times b$ expresses the product of the quantity a by the quantity b, and $a \cdot b$ or ab signifies the same thing. Again 5AB or $5a$ denotes that the quantity AB or a is to be taken 5 times; and $7\,(a+b)$ is 7 times $a+b$; and these numbers 5 or 7, showing how often the quantities are to be taken or multiplied, are called the coefficients. The sign of multiplication between the coefficient and parentheses is very often left out, it being always understood that the quantities which are included by the parentheses, is to be multiplied by the coefficient.

$\div$ denotes *divided by*. The sign of *division*, signifying that the former of the two numbers between which it is placed is to be divided by the latter. Thus, $8 \div 4$ denotes that 8 is to be divided by 4. This is also expressed by placing the dividend above a line, and the divisor below it. Thus, $\frac{8\ \textit{numerator}}{4\ \textit{denominator}}$ denotes that 8 is to be divided by 4. In geometrical lines, also, AB÷CD signifies that the line AB is to be divided by the line CD; or thus, $\frac{\text{AB}}{\text{CD}}$. Otherwise $a \div b$, or $\frac{a}{b}$ shows that the number represented by a is to be divided by that which is represented by b. Also $\frac{a}{b}$ is the reciprocal of $\frac{b}{a}$; and $\frac{1}{a}$ is the reciprocal of a, for the reciprocal of any quantity is that quantity inverted, or unity divided by it.

: is to
::as
: is to
} denote *proportionals*, signifying that the numbers between which they are placed are *proportional.* Thus, 2 : 4 :: 8 : 16, denotes that the number 2 bears the same proportion to 4 as 8 does to 16, and is usually read 2 is to 4 as 8 is to 16.

Proportion in arithmetic is the equality or similitude of ratios, as the four numbers, 2, 4, 8, 16 are proportionals, or in proportion, that is, if $\frac{2}{4}=\frac{8}{16}$, the ratio of 2 to 4 is equal or similar to the ratio of 8 to 16, both of them being the same as the ratio of 1 to 2.

Proportion is often confounded with ratio, but they are quite different things, for ratio is properly the relation of two magnitudes or quantities of one and the same kind, as the ratio of 2 to 4, or of 8 to 16, or of 1 to 2, so that ratio exists between two terms; but proportion between two ratios or four terms.

= denotes *equal to;* the sign of equality, signifying that the numbers between which it is placed are equal to each other. Thus, 2 poles +2 poles=4 poles=22 yards=1 chain =100 links.

—— denotes a *vinculum;* and ( ) denotes *parentheses;* [ ] denotes *crotchets;* and { } denotes *braces.* These signs are made use of to connect two or more quantities together, and they are synonymous with regard to their application; for,

$$(7+4-5)\times 8=[(7+4)-5]\times 8=(11-5)\times 8=6\times 8=48,$$

is the same as

$$[(7+4)-5]\times 8=(11-5)\times 8=6\times 8=48,$$

or

$$\{(7+4)-5\}\times 8=(11-5)\times 8=6\times 8=48,$$

The *vinculum*, or *parentheses*, which includes the 7 and 4, serves as a chain to link them together, or to connect two or more quantities into one, and shows that they are to be added together before the number 5 is subtracted; and the *crotchets*, and also the *braces*, show that the numerals which it includes must be operated upon, and the result multiplied by the number 8.

$^{2\ 3\ n}$ denotes *indices*, or *exponents.* These expressions, placed above a quantity to the right, show to what power it is understood to be raised; as 10^2, 10^3, a^n, &c., which represents the square and cube of 10; and also the *n*th power of *a*; thus, $10^2=10\times 10=100$, and $10^3=10\times 10\times 10=1000$; also a^n, meaning that *a* is a factor as often as there are units in *n*, whatever number *n* may be.

$\surd\ \sqrt[3]{}\ \sqrt[n]{}$ denotes *radical signs.* Any one of these expressions placed before a quantity, represents that the quantity is to have its respective root extracted; it is also expressed by a fractional index, or exponent, placed over, and a little to the right of, the given quantity. Thus the square root of 36 is expressed by $\surd 36$, or $(36)^{\frac{1}{2}}$; the cube root of 64 by $\sqrt[3]{64}$, or $(64)^{\frac{1}{3}}$; and the *n*th root of *a* by $\sqrt[n]{a}$, or $a^{\frac{1}{n}}$, &c.

$^{\circ\ '\ ''\ '''\ ''''}$ denote *degrees, minutes, seconds, thirds,* and *fourths,* when placed above a quantity to the right; thus, 70 *degrees,* 16 *minutes,* 34

seconds, 49 *thirds*, 57 *fourths*, are expressed by 70°, 16′, 34″, 49‴, 57⁗. Also, one of these characters is made use of sometimes to denote a *repeating decimal*, when placed above the quantity to the right; thus, the *repeater* ·819444, &c. is expressed by ·8194′ and the same dash denotes a *circulate*, when placed over its first and last figure to the right; thus, ·769230769230, &c., is expressed by 7′69230′. A dot placed over the figure in circulating decimals, is frequently made use of instead of the dash. Again, some of these characters are made use of for lineal measure; thus, 10 *inches*, 8 *seconds*, 7 *thirds*, 5 *fourths*, are expressed by 10′, 8″, 7‴, 5⁗.

∴ denotes *therefore.*
∵ denotes *because.*
∠ denotes an *angle;* as, ∠ A signifies the angle A.
⊥ denotes *perpendicular to.*
> denotes *greater than*, as A > B, shows that A is greater than B.
< denotes *less than*, as A < B, shows that A is less than B.

AN EXPOSITION OF THE PRINCIPLES OF MONIES, WEIGHTS, AND MEASURES.

In attempting to explain systematically the theory of Monies, Weights, and Measures, the order in which they are generally arranged should be reversed; as it is from Measures that Weights are properly deduced, and Coins are adjusted by Weights.

MEASURES.

Measure, in a commercial sense, signifies the dimensions of any thing bought, sold, or estimated. Measures are of three sorts; namely, Linear, or Long Measure; Square, or Superficial Measure; and Solid, or Cubic Measure.

1. *Linear Measure* is applied to lines; as roads, and distances of all kinds.

2. *Square Measure* is applied to superficies, having both length and breadth; as land, flooring, &c.

3. *Solid Measure* determines the contents of bodies that have length, breadth, and thickness, or depth; as marble, timber, and vessels of all sorts; which last are also called measures of capacity.

Linear Measure is the element of all other measures*.

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* The Long Measures of all nations appear from their names, to have been taken from some part of the human body, as the Foot, the Fathom, &c.; and the following are the proportions generally observed. The Fathom of a well proportioned man is reckoned to equal his height or stature; the girth, or the pace, $\frac{1}{2}$ of his stature; the cubit, $\frac{1}{4}$; the foot, $\frac{1}{6}$; and the span $\frac{1}{8}$. The foot is reckoned equal to 3 times the breadth of the hand, and 12 times that of the thumb. Other proportions are occasionally reckoned, as the nail, the arm, &c.; and these natural measures are often found convenient where artificial measures are wanted.

Square Measure is determined by multiplying length and breadth together; and Solid Measure, by multiplying length, breadth, and depth together.

WEIGHTS.

Weight may be defined a natural property of matter, proportioned to its bulk and the density of its parts. It is determined by being balanced in a scale against some known or acknowledged weight placed in the opposite scale.

A standard for length being once determined, a standard for weight may be thence deduced; as a vessel of any certain dimensions filled with distilled water, or other homogeneous liquid, will always weigh the same in the same latitude.

The following are the chief properties of weight, as demonstrated by *Sir Isaac Newton.*

1. That the weights of all bodies, at equal distances from the centre of the earth, are directly proportional to the quantity of matter that each contains.

2. On different parts of the earth's surface, the weight of the same body is different, increasing from the equator to the pole, in proportion to the square of the sine of the latitude.

3. That the weights of the same body at different distances above the earth, are inversely as the squares of the distances from the centre of the earth.

4. That at different distances within the earth, or below its surface, the weights of the same body are directly as the distances from the earth's centre; so that at half way toward the centre, a body would weigh but half as much, and at the very centre it would have no weight at all.

5. That a body immersed in a fluid which is specifically lighter than itself, loses so much of its weight as is equal to the weight of a quantity of the fluid of the same bulk as the body.

STANDARDS.

Standards, in a commercial sense, signify any measures or weights of acknowledged authority, by which others are sized or adjusted. They are generally distinguished into *Arbitrary Standards,* and *Invariable Standards from nature.* The former are those almost universally adopted, and the latter are intended to restore them if lost, or to serve as models for new systems of metrology.

Among the various plans tried for an Invariable Standard from Nature, the two following only have been acted upon with any degree of success, namely,

1. *The English adopted the length of a pendulum, that vibrated seconds of mean solar time.*

2. *The French adopted the length of an arc, or portion of the meridian circle.*

If the earth had been a perfect sphere, and at rest, these measures would have been the same on all parts of its surface; but its figure is a kind of oblate spheroid, having its equatorial diameter longer than its axis or polar diameter

From this cause, the gravity at the poles is greatest, being nearest to the centre of the earth; and it gradually diminishes to the equator. Hence the vibrations of a pendulum are quickest at the poles, and slowest on the equator; and therefore, in order to measure equal portions of time, the pendulum must be gradually lengthened from the equator to the poles. The weight of bodies on the earth is also affected by centrifugal motion, which at the poles is nothing; but it thence increases to the equator, where the force is greatest; and hence the diminution of gravity is proportioned to the distance of bodies from the poles.

From the spheroidical figure of the earth, too, the degrees of the meridian increase from the equator to the poles, in consequence of the increasing curvature of the quadrantal arc.

In order to ascertain the true figure of the earth, and thence to determine an Invariable Standard for Measure, numerous calculations and experiments have been made by the greatest Mathematicians of modern times; and it may be observed, that nature seems to oppose great obstacles to the undertaking.

It should be stated, that although the Mathematicians of France chose the meridional arc as the basis of their metrical system, they also recommended the pendulum as an accurate Standard, and as the most practical means of restoring or repairing the metre, should it ever be lost, or require correction.

Here it is satisfactory to observe, that the results with respect to the length of the pendulum, thus finally determined at Paris, perfectly correspond with those ascertained in London, in 1817, by Captain Henry Kater, F.R.S.; making allowance for the difference of latitudes. These important operations are fully explained in the Philosophical Transactions of 1818 and 1819.

An Abstract of the late Act for ascertaining and establishing Uniformity of Weights and Measures, which passed in June, 1824, *and commenced operation in January* 1, 1826.

1. The *Standard Yard* is declared to be the distance between the centres of the two points on the gold studs in the straight-brass rod, now in the custody of the clerk of the House of Commons, executed by Mr. Bird, a celebrated optician, whereon is engraved, "*Standard Yard*, 1760," the brass being at the temperature of 62° by Fahrenheit's thermometer. It is to be called the "*Imperial Standard Yard*," from which all other measures of extension, whether lineal, superficial, or solid, are to be divided as formerly. (For its divisions and multiples see Tables VII., IX., X., and XI., pages 33 to 36.)

2. The *Imperial Standard Yard*, if lost, defaced, or otherwise injured, may be restored by comparing it with the pendulum * vibrating seconds

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* As a *pendulum* (or a small leaden ball suspended by a *very fine* thread), when made to vibrate in *very small* arcs, affords a ready means of measuring small portions of time; and as a pendulum vibrating seconds, in addition to its other important uses, forms the most unexceptionable *universal standard of measures*, the following par-

of mean time, in the latitude of London, in a vacuum on the level of the sea, the yard being in proportion of 36 inches to 39·1393 inches of the pendulum, the standard being employed at 62° of Fahrenheit's thermometer.

3. The *Standard Pound* is declared to be the standard brass weight of one pound *troy* weight, made in the year 1758, by order of the Select Committee of the House of Commons, and is called the Parliamentary Pound, and has been recently proved by the general comparisons at the *London Mint*, and now in the custody of the clerk of the House of Commons; and it is denominated "*the Imperial Troy Pound, containing* 5760 *grains;*" from which all other weights are to be divided as formerly; and *one pound avoirdupois* is declared to contain 7000 grains troy weight. (The subdivisions and relations of these weights are contained and explained in *Tables* II. and V., *pages* 29 and 31.)

4. If the imperial pound be lost, defaced, or otherwise injured, it shall be restored by comparison with *a cubic inch of distilled water*, weighed in air by brass weights, at the temperature of 62° Fahrenheit's thermometer, the barometer being at 30 inches. *Such cubic inch of water* is equal to 252·458 grains troy, the *standard troy pound* being 5760 such grains; and the *avoirdupois pound* 7000 such grains troy.

5. The standard measure of capacity, as well for liquids as for dry goods not measured by heaped measure, shall be the gallon, containing ten pounds *avoirdupois* weight, or 12*lb.* 1*oz.* 16*dwts.* 16*grs. troy* of distilled water *, weighed in air at the temperature of 62° of

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ticulars respecting that instrument are subjoined, for the inspection of the inquisitive student.

The times of vibration of pendulums of different lengths are as the square roots of their lengths; and the number of vibrations made in a given time is in the inverse ratio of the square roots of their lengths: *consequently* the lengths of pendulums are as the squares of the times of a vibration; or in the inverse ratio of the squares of the number of vibrations made in a given time.

Examples.

Ex. 1. If the length of a pendulum vibrating seconds, or 60 times in a minute, is 39·1393 inches; in what time will a pendulum 12 inches long vibrate, and how many vibrations will it make in a minute?

As $\sqrt{}$ 39·1393*in.* : $\sqrt{}$ 12*in.* :: 1*sec.* : ·5537 *second.* Also, 12*in.* : 39·1393*in.* :: 60^2 *times* : $108{\cdot}359^2$ *times;* or, $\sqrt{}$ 12*in.* $\sqrt{}$ 39·1393*in.* :: 60*vib.* : 108·359 *vibrations.*

Ex. 2. If the length of a pendulum vibrating seconds is 39·1393 inches, what is the length of a pendulum vibrating half seconds, or 120 times in a minute?

As 1^2 *vib.* : $(\frac{1}{2})^2$ or 120^2 *vib.* : 60^2 *vib.* :: 39·1393*in.* : 9·7848 inches.

Note. The lengths of *pendulums vibrating seconds* vary, with the force of gravity, in different latitudes, and also in the same latitude at different elevations above the level of the sea. (*See article Standards, page* 20.)

* Rain water does not differ from distilled water so as to require any allowance for common purposes.

Fahrenheit's thermometer, the barometer being at 30 inches; and such brass measure shall be "*the Imperial Standard Gallon*," and is declared to be the unit and only standard measure of capacity, being in bulk equal to 277·273843570 cubic inches; from which all other measures of capacity for all sorts of liquids, as well as dry goods not measured by heaped measure, shall be derived; and that all measures, as formerly, shall be taken in parts and multiples, the quart, pint, peck, bushel, and quarter, continuing in the same proportion as heretofore for dry measure. (*See Tables* XII., XIII., XIV., and XV., *pages* 36, 37, and 38.)

6. That the standard measure of capacity for coals, culm, lime, fish, potatoes, or fruit, and all other goods and things commonly sold by heaped measure, shall be the imperial bushel, containing 80 pounds avoirdupois weight, or 97*lbs.* 2*oz.* 13*dwts.* 8*grs. troy* weight of water, the vessel being cylindrical, with an even bottom 8 inches deep, whose internal diameter is 18·78933 inches, the rim being ·355 of an inch thick, and the diameter from outside to outside 19½ inches (*see New Measure Table, page* 25): the exterior diameter of the bushel (19½ in.) to be the diameter of the heap or base of the cone, which must be at the least 6 inches high; so that the solid content of the heaped bushel was formed by adding to the cylindrical content a cone whose diameter at the base is 19½ inches, and height 6 inches; *viz.* 2218·192 +597·295=2815·487 cubic inches: and the contents of the other heaped measures were calculated in proportion to this*.

All other measures for heaped goods must also be cylindrical; their diameters must be double their depth, and the height of the cone or heap must be ¾ of the depth of the measure.

Goods *not heaped*, when measured, must be stricken with a cylindrical roller with two inches diameter from end to end; but all goods may still be bought and sold by *weight* of the legal standard, or by any of the weights or measures formerly in use, provided their proportion to the standard weights or measures are marked upon them.

From this abstract it will be seen that the standards of *weight*, and of *lineal measure*, remain the same as those formerly used in England; but instead of the old ale, wine, and corn gallons, a *new gallon*, containing 10*lbs. avoirdupois*, or 70000 *grains troy* of pure water, is now to be used. This definition of the gallon by the weight of distilled water which it contains is of great practical importance, as every individual who possesses weights has it now in his power to *verify* at pleasure any measure of capacity.

The method of reducing the *old measure* into the *new* and *vice versâ*, may be performed with the greatest facility by the help of *factors or multipliers*, as follows:—

FIRST. *Rules for converting Measures of the Old Standards into Im-*

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* It is plain, however, that the actual contents of these measures may vary considerably according as the heap is put on. It would be better if heaped measure were entirely laid aside, and weight substituted in its place.

perial Measures, by multiplying each respective old Measure by the following tabular numbers.

(1.) To convert wine gallons into imperial gallons, multiply by ·8331109; or × by 5 and ÷ by 6.

(2.) To convert ale gallons into imperial gallons, multiply by 1·0170445; or × by 60 and ÷ by 59.

(3.) To convert Scotch pints into imperial gallons, multiply by ·375814.

(4.) To convert Winchester bushels into imperial bushels, multiply by ·96944718; or × by 31 and ÷ by 32.

(5.) To convert wheat bolls into imperial bushels, multiply by 3·9930241.

(6.) To convert barley bolls into imperial bushels, multiply by 5·8251174.

(7.) To convert Scotch links into imperial links, multiply by 1·123024.

(8.) To convert Scotch links into imperial feet, multiply by ·741196.

(9.) To convert Scotch acres into imperial acres, multiply by 1·261183449.

(10.) To convert ℔ Scotch troyes into imperial avoirdupois ℔, multiply by 1·0869928.

SECOND. *Rules for converting Imperial Measures into those of the Old Standard, by multiplying each respective new Measure by the following tabular numbers.*

(1.) To convert imperial gallons into wine gallons, multiply by 1·2003203; or × by 6 and ÷ by 5.

(2.) To convert imperial gallons into ale gallons, multiply by ·9832411; or × by 59 and ÷ by 60.

(3.) To convert imperial gallons into Scotch pints, multiply by 2·66089055.

(4.) To convert imperial bushels into Winchester bushels, multiply by 1·0315157; or × by 32 and ÷ by 31.

(5.) To convert imperial bushels into standard wheat firlots, multiply by 1·001747.

(6.) To convert imperial bushels into standard barley firlots, multiply by ·6866814.

(7.) To convert imperial links into Scotch links, multiply by ·8904527.

(8.) To convert imperial feet into Scotch links, multiply by 1·3491708.

(9.) To convert imperial acres into Scotch acres, multiply by ·79290606.

(10.) To convert ℔ avoirdupois into ℔ Scotch troyes, multiply by ·91996928.

General Rules for reducing the Old-Measures into the New, and vice versâ.

First. *From the Old Measure to the Imperial.*

Rule. As the number of cubic inches in the Imperial Standard is to the number of cubic inches in the Old Standard, so is the number of bushels or gallons, &c., Old Measure, to the number of bushels or gallons, &c., Imperial Measure.

Conversely.

Second. *From the Imperial Measure to the Old.*

Rule. As the number of cubic inches in the Old Standard is to the number of cubic inches in the Imperial Standard, so is the number of bushels or gallons, &c., Imperial Measure, to the number of bushels or gallons, &c., Old Measure.

NEW MEASURE TABLE,

Showing the dimensions and contents of the imperial bushel, and its divisions, computed in accordance with the Treasury regulations, *viz.* making the diameter of each measure at least twice the depth, the height of the cone exactly three-fourths of the depth, and the exterior diameter as directed in the Gazette; from which *data* the interior diameters and depths are deduced.

Dimensions are in Lineal Inches, and Contents in Cubic Inches.	Dimensions.					Contents.			Weight of Cylinder.	
	Exterior Diameter.	Interior Diameter.	Depth.	Breadth of the Rim.	Height of the Cone.	Contents of the Cylinder.	Contents of the Cone.	Total Contents of Heaped Measure.	In Pounds Avoirdupois.	In Grains Troy.
Bushel . . .	19·5	18·789	8·	·355	6·	2218·192	597·295	2815·487	80·	560000
Half-bushel .	15·5	14·936	6·331	·282	4·748	1109·096	298·648	1407·744	40·	280000
Peck	12·25	11·803	5·071	·223	3·803	554·548	149·324	703·872	20·	140000
Gallon . . .	9·75	9·395	4·	·177	3·	277·274	74·662	351·936	10·	70000
Half-gallon .	7·75	7·468	3·165	·141	2·374	138·637	37·331	175·968	5·	35000
Quart	6·125	5·901	2·535	·112	1·902	69·318	18·666	87·984	2·5	17500

OLD MEASURE TABLE,

Showing the contents of the different gallons, bushels, &c., both in weight and measure.

	Contents in Cubic Inches.	Avoirdupois Weight.	Troy Weight.
		lb. oz. dr.	*lb. oz. dwt. gr.*
Bushel	2150 42	77 . 8 . 14·278	94 . 3 . 0 . 10·426
Cubic foot . . .	1728·	62 . 5 . 2·183	75 . 8 . 16 . 23·178
Ale gallon . . .	282·	10 . 2 . 11·634	12 . 4 . 6 . 9·116
Corn gallon . .	268·80¼	9 . 11 . 1·785	11 . 9 . 7 . 13·303
Wine gallon . .	231·	8 . 5 . 4·764	10 . 1 . 9 . 21·765
Mash tun gallon .	227·	8 . 2 . 15·831	9 . 11 . 7 . 19·934
One cubic inch .	1·	0 . 0 . 9·223	0 . 0 . 10 . 12·458

TABLES OF COMPARISON WITH LIQUID AND DRY MEASURES.

WINE MEASURES.

COMPARISON BETWEEN THE OLD WINE MEASURES AND THOSE OF THE NEW IMPERIAL STANDARD.

Old Wine Measures.	New Standard.			
	Gallons.	Quarts.	Pints.	Gills and 100 parts.
A gill.....is equal to	0	0	0	0·83
Half pint.....	0	0	0	1·66
Pint.....	0	0	0	3·33
Quart	0	0	1	2·66
1 gallon.	0	3	0	2·65
10 do. or anker.....	8	1	0	2·58
18 do. or rundlet.	14	3	1	3·87
42 do. or tierce.....	34	3	1	3·70
63 do. or hogshead...	52	1	1	3·55
84 do. or puncheon. .	69	3	1	3·40
126 do. or pipe.....	104	3	1	3·11
252 do. or tun.....	209	3	1	2·23

The New Standards being about $\frac{1}{5}$ larger than the Old Wine Measures, will occasion an advance of about two-pence-halfpenny in every shilling, on the whole price.

BEER MEASURES.

COMPARISON BETWEEN THE OLD BEER MEASURES AND THOSE OF THE NEW IMPERIAL STANDARD.

Old Beer Measures.	New Standard.			
	Gallons.	Quarts.	Pints.	Gills and 100 parts.
A gill.....is equal to	0	0	0	1·02
Half pint.....	0	0	0	2·03
Pint.....	0	0	1	0·07
Quart.....	0	1	0	0·13
1 gallon.....	1	0	0	0·54
9 do. or firkin.....	9	0	1	0·91
18 do. or kilderkin...	18	1	0	1·82
36 do. or barrel.... ...	36	2	0	3·64
54 do. or hogshead...	54	3	1	1·45
72 do. or puncheon..	73	0	1	3·27
108 do. or butt.....	109	3	0	2·91
216 do. or tun.....	219	2	1	1·82

The New Standards being only about $\frac{1}{60}$ part less than the Old Beer Measures will scarcely affect the retail prices.

DRY MEASURES.

COMPARISON BETWEEN THE OLD DRY MEASURES, AND THOSE OF THE NEW IMPERIAL STANDARD.

Old Dry Measures.	New Standard.					
	Bushels.	Pecks.	Gallons.	Quarts.	Pints.	Gills and 100 parts.
A gill is equal to	0	0	0	0	0	0·97
Half pint.....	0	0	0	0	0	1·94
Pint.....	0	0	0	0	0	3·88
Quart.....	0	0	0	0	1	3·75
Gallon.....	0	0	0	3	1	3·02
2 gallons or 1 peck	0	0	1	3	1	2·04
1 bushel...	0	3	1	3	0	0·17
2 do. or strike.....	1	3	1	2	0	0·35
4 do. or combe....	3	3	1	0	0	0·70
8 do. or quarter..	7	3	0	0	0	1·41

Old Dry Measures.	New Standard.					
	Bushels.	Pecks.	Gallons.	Quarts.	Pints.	Gills and 100 parts.
32 bush. or chald.	31	0	0	0	1	1.64
36 do. or chald. of coals.....	34	3	1	0	1	2·34
40 do. or wey.....	38	3	0	0	1	3·06
80 do. or last... ...	77	2	0	1	1	2·13

The New Dry Measures being about $\frac{1}{32}$ part larger than the Old, may naturally be expected to occasion an advance of about 3 per cent. upon the old prices.

Of Money.

The lowest piece of money used in England is a half-farthing, and all accounts are kept in pounds, shillings, pence, and farthings.

Note. £ denotes pounds, *s.* shillings, *d.* pence, and *q.* farthings.*
$\frac{1}{4}$ ..... a farthing, or the quarter of any thing.
$\frac{1}{2}$ ..... a halfpenny, or the half of any thing.
$\frac{3}{4}$ ..... three farthings, or three quarters of any thing.

Imaginary English Coin.

A mark ..	value	13*s.* 4*d.*	A moidore,	value	27*s.* 0*d.*
A noble ..	—	6 . 8	A Jacobus	—	25 . 0
A tester ..	—	0 . 6	A Carolus	—	23 . 0
A groat ..	—	0 . 4	An angel	—	10 . 0

The following statement is the full weight of gold and silver coins in *troy* weight:—

Gold Coins.—*Old Coinage.*

	dwt.	gr.
Guinea ..... weighs	5 .	$9\frac{39}{89}$
Half-guinea	2 .	$16\frac{64}{89}$
Seven-shilling piece....	1 .	$19\frac{13}{89}$

New Coinage.

Sovereign	5 .	$3\frac{171}{623}$
Half-sovereign	2 .	$13\frac{397}{623}$
Double-sovereign	10 .	$6\frac{342}{623}$
Five-sovereign piece..	25 .	$16\frac{232}{623}$

Silver Coins.—*Old Coinage.*

	dwt.	gr.
Crown .....weighs	19 .	$8\frac{16}{31}$
Half-crown	9 .	$16\frac{8}{31}$
Shilling	3 .	$20\frac{28}{31}$
Sixpence	1 .	$22\frac{14}{31}$
New Coinage.		
Crown	18 .	$4\frac{4}{11}$
Half-crown	9 .	$2\frac{2}{11}$
Shilling	3 .	$15\frac{3}{11}$
Sixpence	1 .	$19\frac{7}{11}$
Fourpence	1 .	$5\frac{1}{11}$

The relative proportion between gold and silver in the English coins, according to the mint regulations, both of the old and new coinage.—The *old coinage* is as any given weight of gold is to an equal weight of silver, as 15·2096 to 1. The *new coinage* is as 14·2878 to 1.

Note. Gold coins are allowed by *law* to pass under the above full weight. Thus the guinea, weighing 5*dwt.* 8*gr.*; the sovereign, 5*dwt.* $2\frac{3}{4}$*gr.*; and their divisions, in proportion, are a legal tender.

The standard of gold coin is 22 parts of pure gold, and 2 parts of copper, or some other alloy melted together†. From a pound of

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* The italic letters, £. *s. d.* and *q.* are taken from the Latin words, *libræ*, pounds, *solidi*, shillings, *denarii*, pence, and *quadrantes*, farthings.

† Any quantity of gold, as a pennyweight, is supposed to be divided into twenty-four equal parts called *carats*. When the whole is pure, it is said to be 24 carats fine; when 23 grains are pure and one is alloy, it is said to be 23 carats fine, and so on. Wrought gold has two legal standards: one is 22 carats, the same as the coin, and the other 18 carats fine. The latter commenced in 1798, and is used chiefly in watch-cases and rings.

standard gold are coined $44\frac{1}{2}$ guineas, 89 half-guineas, or $133\frac{1}{2}$ seven-shilling pieces. Also $46\frac{29}{40}$ sovereigns, with divisions and multiples in proportion. Hence the mint price of gold is 3*l.* 17*s.* $10\frac{1}{2}$*d.* per ounce, or 46*l.* 14*s.* 6*d.* per pound troy. There is no alteration, either in weight or fineness, from former coinages, the sovereign, or 20*s.* piece, being $\frac{20}{21}$ of the weight and value of a guinea.

The current silver coin is 11*oz.* 2*dwt.* of pure silver, and 18*dwt.* of copper. The new coin is minted at 5*s.* 6*d.* per ounce, or 3*l.* 6*s.* per pound troy: thus, from 1*lb.* troy of this standard are now coined $13\frac{1}{3}$ crowns, $26\frac{2}{3}$ half-crowns, 66 shillings, or 132 sixpences.

It should be stated that the new silver coin is not a legal tender for any sum above 40 shillings, and in the year 1816 gold coins were declared to be the only legal tender in all payments beyond that sum.

The copper money is coined in the proportion of 24 pence to the pound avoirdupois. Thus the penny should weigh $10\frac{2}{3}$ drams, or $291\frac{2}{3}$ troy grains, and the other pieces in proportion. Copper pence, half-pence, and farthings, are not a legal tender for more than 12 pence, and the half-farthings for not more than the value of sixpence.

TABLE I.—*Of English Coins.*

Half Farthings.	Farthings.	Halfpence.	Pence.	Fourpences.	Sixpences.	Shillings.	Half-crowns.	Crowns.	7-Shilling Pieces.	Half Sovereigns.	Half Guineas.	Sovereigns.	* Guineas.
2	= 1												
4	2	= 1											
8	4	2	= 1										
32	16	8	4	=1									
48	24	12	6	$1\frac{1}{2}$	=1								
96	48	24	12	3	2	=1							
240	120	60	30	$7\frac{1}{2}$	5	$2\frac{1}{2}$	=1						
480	240	120	60	15	10	5	2	=1					
672	336	168	84	21	14	7	$2\frac{4}{5}$	$1\frac{2}{5}$	=1				
960	480	240	120	30	20	10	4	2	$1\frac{3}{7}$	=1			
1008	504	252	126	$31\frac{1}{2}$	21	$10\frac{1}{2}$	$4\frac{1}{5}$	$2\frac{1}{10}$	$1\frac{1}{2}$	$1\frac{1}{20}$	=1		
1920	960	480	240	60	40	20	8	4	$2\frac{6}{7}$	2	$1\frac{19}{21}$	=1	
2016	1008	504	252	63	42	21	$8\frac{2}{5}$	$4\frac{1}{5}$	3	$2\frac{1}{10}$	2	$1\frac{1}{20}$	=1

Besides the above there are the 5*l.* piece weighing 25*dwt.* 16·37*gr.*, which equals 100*s.*; the double-sovereign weighing 10*dwt.* 6·548*gr.*, which equals 40*s.*

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* The guinea varied in its current price from 20 shillings up to 30 until the year 1717, when, by the recommendation of Sir Isaac Newton, it was fixed at 21 shillings, its present rate.

A TABLE OF DISCOUNT PER CENT.

	s.	d.			s.	d.	
2½ per cent. is	0	6	in a pound.	27½ per cent. is	5	6	in a pound.
5 —	1	0	—	30 —	6	0	—
7½ —	1	6	—	32½ —	6	6	—
10 —	2	0	—	35 —	7	0	—
12½ —	2	6	—	37½ —	7	6	—
15 —	3	0	—	40 —	8	0	—
17½ —	3	6	—	42½ —	8	6	—
20 —	4	0	—	45 —	9	0	—
22½ —	4	6	—	47½ —	9	6	—
25 —	5	0	—	50 —	10	0	—

TABLE II.—*Of Troy Weight.*

By this weight are weighed gold, silver, jewels, amber, and some liquids.

Drams Avoird.	Blanks.	Periots.	Doits.	Mites.	Pearl Grains.	Troy Grains.	Diamond Carats.	Penny-Weights.	Ounces.	Pound.
$\frac{1}{6300000}$	= 1									
$\frac{1}{262500}$	24	= 1								
$\frac{1}{13125}$	480	20	= 1							
$\frac{8}{4375}$	11520	480	24	= 1						
$\frac{128}{4375}$	184320	7680	384	16	= 1					
$\frac{32}{875}$	230400	9600	480	20	$1\frac{1}{4}$	= 1				
$\frac{2048}{17675}$	$729980\frac{20}{101}$	$30415\frac{85}{101}$	$1520\frac{80}{101}$	$63\frac{37}{101}$	$3\frac{97}{101}$	$3\frac{17}{101}$	= 1			
$\frac{768}{875}$	5529600	230400	11520	480	30	24	$723\frac{23}{40}$	= 1		
$17\frac{97}{175}$	110592000	4608000	230400	9600	600	480	$151\frac{1}{2}$	20	= 1	
$210\frac{114}{175}$	1327104000	55296000	2764800	115200	7200	5760	1818	240	12	= 1

Note 1. 25*lb.*=one quarter of a *cwt.*; 100*lb.*=1*cwt*; and 20*cwt.* 1 *ton* of gold or silver.

Note 2. 1*st.* The grain troy is composed of 20 mites, the mite of 24 doits, the doit of 20 periots, and the periot of 24 blanks. These divisions are seldom noticed below mites, except in calculation; but in weighing, where great nicety is required, decimal divisions are used to the thousandth part of a grain.

2*nd.* Diamonds and other precious stones are weighed by carats, each carat being divided by halves, quarters, eighths, sixteenths, &c. The ounce troy weighs $151\frac{1}{2}$ diamond carats; this carat is therefore $3\frac{17}{101}$ or $3\frac{1}{8}$ grains troy *nearly*.

3*rd.* Pearls are weighed by the troy standard; but the pennyweight is divided into 30 grains instead of 24, and therefore the ounce contains 600 pearl grains: hence 4 troy grains equal 5 pearl grains.

Note 3. It has been found by experiment, that, at the temperature of 62° of Fahrenheit's thermometer, 1 cubic inch of distilled water weighs

252·722 grains troy in a vacuum, or 252·456 grains in air; and that at the maximum of density, that is at 39°, it weighs in a vacuum 253 grains troy. Hence, at the temperature of 62°, 1 cubic foot of distilled water weighs 998·17969 avoirdupois ounces in a vacuum, or 997·129069 avoirdupois ounces in air; and at the temperature of 39°, it weighs 999·2777 avoirdupois ounces in a vacuum.

The troy ounce measure of water is equal to 1·901307$\frac{3}{7}$ cubic inches,
The avoirdupois ounce measure of water is equal to 1·7329$\frac{5}{8}$ cubic inches,
} at the temperature of 62° of Fahrenheit's thermometer.

A cubic foot, or 1728 cubic inches, of air weighs 528·367 grains *troy*, or 1·207696 ounces *avoirdupois*.

Table III.—*Of Apothecaries' Weight.*

Apothecaries, chemists, &c., use this weight in mixing medicines, but buy and sell their drugs by avoirdupois weight.

Drams Avoird.	gr. Grains.	℈ Scruples.	ʒ Drams.	℥ Ounces.	℔ Pound.
$\frac{32}{875}$	= 1				
$\frac{128}{175}$	20	= 1			
$2\frac{34}{175}$	60	3	= 1		
$17\frac{97}{175}$	480	24	8	= 1	
$210\frac{114}{175}$	5760	288	96	12	= 1

Note. The apothecaries' pound and ounce, and the pound and ounce troy, are the same, only differently divided and subdivided.

Table IV.—*Of Fluid Measure, used by Apothecaries, &c.*

In the measurement of liquids the standard imperial gallon (containing 277·273843570 cubic inches, being equal to 10*lb. avoirdupois* or 12*lb.* 1*oz.* 16*dwt.* 16*gr. troy*, of distilled water weighed in air at the temperature of 62° of Fahrenheit's thermometer, the barometer being at 30 inches) is subdivided for medical purposes into *avoirdupois*, thus—

Cubic Inches.	Weight in Grs. Troy.	Weight in Drams Avoird.	♏ Minims.	f ʒ Fluid Drams.	f ℥ Fluid Ounces	O. Pints.	C. Gallon.
·2166$\frac{13}{64}$	= 54$\frac{11}{16}$	= 2	=60	= 1			
1·7329$\frac{5}{8}$	437$\frac{1}{2}$	16	480	8	= 1		
34·659$\frac{1}{4}$	8750	320	9600	160	20	= 1	
277·274	70000	2560	76800	1280	160	8	= 1

Note. Besides these measures, other irregular measures of uncertain content are used:

A table-spoonful, *cochlearium magnum*, of syrup, ℥ss, or $\frac{1}{2}$ *oz.*
——————— of distilled waters, ʒiijss to ℥ss, or 3$\frac{1}{2}$*dr.* to $\frac{1}{2}$*oz.*
——————— of spirits and tinctures, ʒij to ʒiij, or 2*dr.* to 3*dr.*

A dessert-spoonful, *cochlearium mediocre*, of water, ℥ij, or 2*dr.*
A tea-spoonful, *cochlearium parvum*, of syrup, ℥j to ℥ij, or 1*dr.* to 2*dr.*
——————— of distilled water, ℈jss to ℈ij, or $1\frac{1}{2}$*sc.* to 2*sc.*
——————— of spirit and tinctures, ℈j to ℈jss, or 1*sc.* to $1\frac{1}{2}$*sc.*
——————— of light powder, as magnesia, ℈ss to ℈j, or $\frac{1}{2}$*sc.* to 1*sc.*
——————— of a heavy powder, as sulphur, ℈jss to ℈ij, or $1\frac{1}{2}$*sc.* to 2 *sc.*
——————— of a metallic oxide, ℥j to ℈iiij, or 1*dr.* to 4*sc.*

A thimbleful, *clypeola metallica pro digitis*, is usually the same as a tea-spoonful.

A tea-cup, *vasculum pro thea*, ℨiij to ℨiv, or 3*oz.* to 4*oz.*
A wine-glass, *scyphus pro vino*, *cyathus*, ℨjss, or $1\frac{1}{2}$*oz.*

Table V.—*Of Avoirdupois Weight*

By avoirdupois weight are weighed such commodities as are coarse and drossy, or subject to waste, as groceries of all kinds, bread, butter, cheese, and most other common necessaries of life; pitch, tar, resin, wax, tallow, flax, &c.; as are likewise all metals, *silver and gold excepted.*

Grains, Troy.	Drams.	Ounces.	Pounds.	Quarters.	Hundreds.	Ton.
$27\frac{11}{32}$	= 1					
$437\frac{1}{2}$	16	= 1				
7000	256	16	= 1			
196000	7168	448	28	= 1		
784000	28672	1792	112	4	= 1	
15680000	573440	35840	2240	80	20	=1

Note 1. The avoirdupois ounce is less than the troy ounce by $1\frac{97}{175}$ *dr. av.* or $42\frac{1}{2}$*gr. tr.*, or in the ratio of 175 to 192; but the avoirdupois pound is greater than the troy pound by $45\frac{61}{175}$*dr. av.* or 1240*gr. tr.*, or in the ratio of 175 to 144. Therefore, 175*oz. troy* are equal to 192 *oz. av.*; and 175*lb. troy* are equal to 144*lb. avoirdupois.* Hence

To convert avoirdupois weight to troy weight—

As 144*lb. av.* : 175*lb. tr.* :: 1*lb. av.* : $1\frac{31}{144}$*lb. tr.*=14*oz.* 11*dwt.* 16*gr. tr.*

As 192*oz. av.* : 175*oz. tr.* :: 1*oz. av.* : $\frac{175}{192}$*oz. tr.*=18*dwt.* $5\frac{1}{2}$*gr. tr.*

Again, to convert troy weight to avoirdupois weight—

As 175*lb. tr.* : 144*lb. av.* :: 1*lb. tr.* : $13\frac{29}{175}$*oz. av.*=13*oz.* $2{\cdot}65\frac{1}{7}$*dr. av.*
As 175*oz. tr.* : 192*oz. av.* :: 1*oz. tr.* : $1\frac{17}{175}$*oz. av.*=1*oz.* $1{\cdot}55\frac{3}{7}$ *dr. av.*

Consequently we have, from the above proportions,

1*lb.* avoirdupois=14*oz.* 11*dwt.* 16*gr.* troy=7000*gr.*
1*oz.* avoirdupois=18*dwt.* $5\frac{1}{2}$*gr.* troy=$437\frac{1}{2}$*gr.*
1*lb.* troy=13*oz.* $2{\cdot}65\frac{1}{7}$*dr.* avoirdupois=$210{\cdot}65\frac{1}{7}$*dr.*
1*oz.* troy=1*oz.* $1{\cdot}55\frac{3}{7}$*dr.* avoirdupois=$17{\cdot}55\frac{3}{7}$*dr.*

Note 2. There are several sorts of silk weighed by the great pound of 24*oz.*, others by the common pound of 16*oz.* Hence, to reduce great pounds to common, multiply by 3, and divide by 2, or add one-half; and to bring common pounds into great, multiply by 2, and divide by 3, or subtract one-third.

A firkin of butter, 56*lb.*
——— soap 64*lb.*
A barrel of raisins, 112*lb.*
——— soap, 256*lb.*
A puncheon of prunes, 1120*lb.*
A barrel of anchovies, 30*lb.*
A fodder of lead in London and Hull = 19½*cwt.*; at Stockton = 22*cwt.*: at Chester = 20*cwt.*; at Derby = 22½*cwt.*; at Newcastle = 21*cwt.*; and at Bawtry = 21½ *cwt.*—The *cwt.* of lead at Hull and Chester = 120*lb.*
A stone of iron or shot, or horseman's weight, 14*lb.*
A stone, butcher's meat in London, 8*lb.*
A stone, ditto, in the country 14*lb.*
A clove, or half stone, of butter or cheese, 8*lb.*
A way in Suffolk, or 32 cloves, 256*lb.*
——— Essex, or 42 cloves, 336*lb.*
An imperial gallon of train oil, 9*lb.*
A truss of straw, 36*lb.*
——— new hay, 60*lb.* to 64*lb.*
——— old hay, 56*lb.*
A load, 36 trusses.

Note.—Hay of any year is reckoned old after the end of August.

Bread.	*lb.*	*oz.*	*dr.*
A peck loaf weighs	17	6	1
A half-peck loaf . .	8	11	0½
A quartern	4	5	8¼
A half-quartern . .	2	2	12⅛

Flour.		
A peck of flour = 14·44 pounds.		
A bushel of flour 57·76 do.		
A sack, or 5 bush. of flour	288·80	do.

The assize in the price of bread was abolished by an act of parliament in 1815, and the rate of the peck loaf left open to the competition of the trade.

By a recent act of parliament, whose operation commenced on the 29th September, 1822, bread is sold within 10 miles of London by the pound, such as 4*lb.* loaves, 2*lb.* loaves, &c.

Table VI.—*Of Wool Weight.*

Pounds.	Cloves.	Stones.	Tods.	Weys.	Packs.	Sacks.	Last.
7	= 1						
14	2	= 1					
28	4	2	= 1				
182	26	13	6½	= 1			
240	34⅔	17⅐	8⅘	1 29/91	= 1		
364	52	26	13	2	1 31/60	= 1	
4368	624	312	156	24	18⅕	12	= 1

Note. In some places 7 tods make 1 wey. In purchasing wool from the grower, 28*lbs.* make a legal tod; but woolstaplers, in transacting business with one another, and with manufacturers, allow 30*lbs.* to the tod, and 8 tods to the pack.

TABLE VII.—*Of Cloth Measure.*

Cloth measure is used by linen and woollen-drapers. Hollands are measured by the English ell, and tapestry by the Flemish ell; woollens, linens, wrought silks, tape, &c., by the yard.

Inches.	Nails.	Quarters.	Ells Flemish	Yard.	Ell English.	Ell French.
$2\frac{1}{4}$	= 1					
9	4	= 1				
27	12	3	= 1			
36	16	4	$1\frac{1}{3}$	= 1		
45	20	5	$1\frac{2}{3}$	$1\frac{1}{4}$	= 1	
54	24	6	2	$1\frac{1}{2}$	$1\frac{1}{5}$	= 1

TABLE VIII.—*Of Yarn Measure.*

COTTON-YARN. WORSTED-YARN.

Inches.	Threads.	Skeins, Leas, or Raps.	Hanks, or 560 yards.	Spindle.	Inches.	Threads.	Leas, or Raps.	Hank, or 560 yards.
54	= 1				36	= 1		
4320	80	= 1			2880	80	= 1	
30240	560	7	= 1		20160	560	7	= 1
544320	10080	126	18	= 1				

LINT, OR LINEN-YARN.

Inches.	Yards.	Threads.	Leas, Cuts, or Raps.	Heers.	Slips.	Hasps.	Spindles.	Bundle.
36	= 1							
90	$2\frac{1}{2}$	= 1						
10800	300	120	= 1					
21600	600	240	2	= 1				
108000	3000	1200	10	5	=1			
129600	3600	1440	12	6	$1\frac{1}{5}$	= 1		
518400	14400	5760	48	24	$4\frac{4}{5}$	4	=1	
2160000	60000	24000	200	100	20	$16\frac{2}{3}$	$4\frac{1}{6}$	= 1

Note. Ermland yarn is $85\frac{1}{2}$*in.* to one thread, and 40*thd.* to one lea; Hamburgh yarn is 80*in.* to one thread, and 90*thd.* to one lea. Also, the cotton-reel is 54*in.* in circuit; the linen-reel is 90*in.* in circuit; the worsted-reel is 30*in.* in circuit; the ounce-thread-reel is 30*in.* in circuit; and a hank of this yarn is 30*thd.*

TABLE IX.—*Of Lineal or Long Measure.*

This measure is used to measure distances, lengths, breadths, heights, depths, &c., of places or things.

Inches.	Gunter's Link.	Feet.	Yards.	Fathms.	Rods, Poles, or Perches.	Gunter's Chains.	Furlongs.	Mile.
$7\frac{23}{25}$	= 1							
12	$1\frac{17}{33}$	= 1						
36	$4\frac{6}{11}$	3	= 1					
72	$9\frac{1}{11}$	6	2	= 1				
198	25	$16\frac{1}{2}$	$5\frac{1}{2}$	$2\frac{3}{4}$	= 1			
792	100	66	22	11	4	= 1		
7920	1000	660	220	110	40	10	=1	
63360	8000	5280	1760	880	320	80	8	=1

Note 1. Besides the above, there are, the barley-corn, which equals $\frac{1}{3}$ of an inch: the inch also is subdivided into quarters, eighths, tenths, twelfths, &c.; the palm=3*in.*; the hand=4*in.*; the span=9*in*; the cubit=$1\frac{1}{2}$*ft.*; the common military pace=2*ft.* 6*in.*: the geometrical pace=5*ft.* A geographical or sea mile is $\frac{1}{3}$ of a sea league, and 20 sea leagues make a degree of the meridian. A degree of the meridian in the latitude of England, at the meridian of 52°, was found by Colonel Mudge in 1800, to equal 69·114 English miles. A sea league is therefore 3·4557 English miles, in the same latitude.

A rope=20*ft.*; a woodland pole=18*ft.*; a forest or plantation pole=21*ft.*; a Cheshire pole=24*ft.*; a Sherwood forest pole=25*ft.*; and one rood of fencing or ditching=7*yds.*

Note 2. The velocity of sound in the atmosphere has been recently measured with great care by a committee of the members of the Institution of France; the result of their observations was, that at the temperature of 50° of Fahrenheit's thermometer, the velocity of sound is $1106\frac{1}{3}$ English feet in a second; or 1089·3 feet in a second, *at the freezing point.* When transmitted by *solid* bodies, or through *tubes*, sound travels 10 times faster than when it passes through the open air.

Note 3. The velocity of light is estimated to travel at the rate of about 194000 miles in one second of time; a conclusion which is placed beyond every possible doubt, by the aberration of the stars discovered by the celebrated Dr. Bradley. Such is the velocity of light, that the earth, moving at the rate of nineteen miles in a second, would take two months to pass through a distance which a ray of light would dart over in eight minutes.

Note 4. It has been found by numberless experiments that gravity is a force of such a nature, that all bodies, whether light or heavy, fall vertically through equal spaces in the same time, in a vacuum; as lead or gold, and a feather, which in an exhausted receiver, fall from the top to the bottom in the same time. It is also found that the velocities acquired by descending, are in the exact proportion of the times of descent; and further, that the spaces descended are proportional to the

squares of the times, and, therefore, to the squares of the velocities. Hence, it follows that the weights of gravities, of bodies near the surface of the earth, are proportional to the quantities of matter contained in them. Further, as it is found, by accurate experiments, that a body in the latitude of London, falls about $16\frac{1}{12}$ *feet* in the first second of time, consequently at the end of that time it has acquired a velocity double, or of $32\frac{1}{6}$ feet. Then because the velocities are generated in that time, and are directly proportional to the times, and the spaces as the squares of either, therefore

If the times be as the numbers	1, 2, 3, 4, 5, &c.
The velocities will also be as	1, 2, 3, 4, 5, &c.
And the spaces as their squares	1, 4, 9, 16, 25, &c.
And the spaces for each time as	1, 3, 5, 7, 9, &c.

namely as the series of the odd numbers which are the differences of the squares denoting the whole spaces. So that if the first series of natural numbers be seconds of time, namely—

The times in seconds	$1''$,	$2''$,	$3''$,	$4''$, &c.
The velocities in feet will be	$32\frac{1}{6}$,	$64\frac{1}{3}$,	$96\frac{1}{2}$,	$128\frac{2}{3}$, &c.
The spaces in the whole times	$16\frac{1}{12}$,	$64\frac{1}{3}$,	$144\frac{3}{4}$,	$257\frac{1}{3}$, &c.
And the space for each second	$16\frac{1}{12}$,	$48\frac{1}{4}$,	$80\frac{5}{12}$,	$112\frac{7}{12}$, &c.

of which spaces the common difference is $32\frac{1}{6}$ feet (*See Example* 21, *Arithmetical Progression*), and this, therefore, is called the natural force of gravity, and by it all other forces are compared. Galileo was the first who discovered the above laws on falling bodies.

TABLE X.—*Of Superficial or Square Measure.*

Square measure is used to measure all kinds of superficies, such as land, paving, flooring, plastering, roofing, slating, tiling, and every thing that has length and breadth.

Square Inches.	Square Links	Square Feet.	Square Yards.	Sq. Rods, Poles, or Perches.	Sq. Chains	Sq. Roods.	Sq. Acres.	Sq. Miles.
$62\frac{454}{625}$	= 1							
144	$2\frac{322}{1089}$	= 1						
1296	$20\frac{80}{121}$	9	= 1					
39204	625	$272\frac{1}{4}$	$30\frac{1}{4}$	= 1				
627264	10000	4356	484	16	= 1			
1568160	25000	10890	1210	40	$2\frac{1}{2}$	= 1		
6272640	100000	43560	4840	160	10	4	= 1	
4014489600	64000000	27878400	3097600	102400	6400	2560	640	= 1

Note 1. The inch, in squaring dimensions, is divided into 12 seconds, and each second into 12 thirds; and in the same manner, if the operation be carried further, every successive place will be a 12*th* part of that preceding it, being a Duodenary Scale of Notation.

Note 2. A hide of land=100 acres; a yard of land=30 acres; a square of flooring, partitioning, roofing, tiling, and slating, are each =100*sq. ft.*; a rod of brick-work=272·25*sq. ft.*; in some places it is customary to allow 324*sq. ft.* to a rod; sometimes a rod=21*ft.* long and 3*ft.* high=63*sq. ft.*

TABLE XI.—*Of Cubic or Solid Measure.*

This is used in mensuration to measure all kinds of solids, or such figures as consist of three dimensions, viz. length, breadth, and depth, or thickness.

Imperial Gallons.	Cubic Inches.	Cubic Feet.	Cubic Yards.	Cubic Rods, Poles, or Perches.	Cubic Furlongs.	Cubic Mile.
·0036065408224355 69	= 1					
6·232102541168663 49	1728	= 1				
168·26676861155391 4	46656	27	= 1			
27995·38362774728 25	7762392	$4492\frac{1}{8}$	$166\frac{3}{8}$	= 1		
1791704552·175826 08	496793088000	287496000	10648000	64000	= 1	
917352730714·0229 52	254358061056000	147197952000	5451776000	32768000	512	= 1

Note. A load of rough timber = 40*cub. ft.*; a load of squared timber = 50*cub. ft.*; a ton of shipping = 42*cub. ft.*; a barrel bulk = 5*cub. ft.*; a floor of earth = 324*cub. ft.*; a cord of wood = 8*ft.* long, 4*ft.* broad, and 4*ft.* deep = 128*cub. ft.*; a stack of wood = 12*ft.* long, 3*ft.* broad, and 3*ft.* deep = 108*cub. ft.*; a solid yard of earth = 1 load; a cubic foot of water weighs 1000 *ounces avoirdupois*, or 911*oz.* 9*dwts.* 4*grs. troy.*

TABLE XII.—*Liquid Measure.*

By this measure all wines, brandy, rum, spirits, distilled liquors, cyder, perry, mead, vinegar, honey, oil, &c., are measured, bought, and sold.

Cubic Inches.	Gills.	Pints.	Quarts.	Imp. Gallons.	Ankers.	Runlets.	Barrels.	Tierces.	Hogsheads.	Puncheons.	Pipes or Butts.	Tun.
$8·664\frac{13}{16}$	= 1											
$34·659\frac{1}{4}$	4	= 1										
$69·318\frac{1}{2}$	8	2	= 1									
277·274	32	8	4	=1								
2772·740	320	80	40	10	=1							
4990·932	576	144	72	18	$1\frac{4}{5}$	=1						
8734·131	1008	252	126	$31\frac{1}{2}$	$3\frac{3}{20}$	$1\frac{3}{4}$	=1					
11645·508	1344	336	168	42	$4\frac{1}{5}$	$2\frac{1}{3}$	$1\frac{1}{3}$	=1				
17468·262	2016	504	252	63	$6\frac{3}{10}$	$3\frac{1}{2}$	2	$1\frac{1}{2}$	=1			
23291·016	2688	672	336	84	$8\frac{2}{5}$	$4\frac{2}{3}$	$2\frac{2}{3}$	2	$1\frac{1}{3}$	1		
34936·524	4032	1008	504	126	$12\frac{3}{5}$	7	4	3	2	$1\frac{1}{2}$	1	
69873·048	8064	2016	1008	252	$25\frac{1}{5}$	14	8	6	4	3	2	1

Note. To understand the solutions to some of the questions in this work, it is necessary to remark, that a pipe of Claret contains 126 *gallons*; Port, 138; Sherry, 130; Lisbon, 140; Bucellas, 140; Maderia, 110; and Vidonia, 120 *gallons.*

TABLE XIII.—*Of Ale and Beer Measure.*

By this measure all malt liquors and water are measured.

Cubic Inches.	Pints.	Quarts.	Imp. Gallons.	Firkins.	Kilderkins.	Barrels.	Hogsheads.	Puncheons.	Butts.	Tun.
34·659¼	= 1									
69·318½	2	= 1								
277 274	8	4	= 1							
2495·466	72	36	9	= 1						
4990·932	144	72	18	2	= 1					
9981·864	288	144	36	4	2	= 1				
14972·796	432	216	54	6	3	1½	= 1			
19963·728	576	288	72	8	4	2	1⅓	= 1		
29945·592	864	432	108	12	6	3	2	1½	= 1	
59891·184	1728	864	216	24	12	6	4	3	2	= 1

TABLE XIV.—*Of Corn and Dry Measure.*

Dry measure is used in measuring all *dry* commodities, as wheat, barley, beans, and other grain, fruit, roots, sand, salt, coals, oysters, &c.

Cubic Inches Heaped Measure.	Cubic Inches Stricken Measure.	Pints.	Quarts.	Pottles.	Imp. Gallons.	Pecks.	Bushels.	Strikes.	Cooms or Sacks.	Quarters.	Weys or Loads.	Last.
43·9916 3/64	34·659¼	= 1										
87·9833 1/32	69·318½	2	= 1									
175·9671 15/16	138·637	4	2	= 1								
351·935 7/8	277·274	8	4	2	= 1							
703·871¾	554·548	16	8	4	2	= 1						
2815·487	2218·192	64	32	16	8	4	= 1					
5630·974	4436·384	128	64	32	16	8	2	= 1				
11261·948	8872·768	256	128	64	32	16	4	2	= 1			
22523·896	17745·536	512	256	128	64	32	8	4	2	= 1		
112619·480	88727·680	2560	1280	640	320	160	40	20	10	5	= 1	
225238·960	177455·360	5120	2560	1280	640	320	80	40	20	10	2	= 1

Note. A load of corn = 5 bushels; a cart-load of corn = 40 bushels; and 7922 wheat or barley-corns are supposed to fill a pint measure.

OLD AND NEW COAL MEASURE.

An act of parliament passed in 1831 for the better regulation of the sale of all sorts of coals, cinders, and culm in London and its vicinity. Coals within the distance of 25 miles from the General Post-Office, St. Martin's-le-Grand, London, are now sold by weight, which, previous to this act, were sold by heaped measure. The standard weight for coals,

consisting of one sack, is declared to weigh 2*cwt.* or 224*lb.*; consequently, 10 sacks should weigh 1 ton or 2240*lb.*

In various other parts of the United Kingdom it is customary to sell the coals by heaped measure, and at other places by weight; therefore, it was thought fit to compute a table to answer both purposes, which will be found as follows:—

TABLE XV.—*Of Coal Measure.*

Cubic Inches Heaped Measure.	Pounds Weight Avoir.	Pecks.	Bushels.	Sacks.	Vats, or Strikes.	Load. Chald.	Newc. Chald.	Keels.	Scores.	Ship Load.
703·872	= 18 2/3	= 1								
2815·487	74 2/3	4	= 1							
8446·461	224	12	3	= 1						
25339·383	672	36	9	3	= 1					
101357·532	2688	144	36	12	4	= 1				
196380·218¼	5208	279	69¾	23¼	7¾	1 15/16	= 1			
1571041·746	41664	2232	558	186	62	15½	8	= 1		
2128508·172	56448	3024	756	252	84	21	10 26/31	1 11/31	= 1	
31420834·92	833280	44640	11160	3720	1240	310	160	20	14 16/21	= 1

TABLE XVI.—*Of the Measure of Time.*

Seconds.	Minutes.	Hours.	Days.	Weeks.	Months.	Common Calendar Year.	Julian Year.	Leap Year.
60	= 1							
3600	60	= 1						
86400	1440	24	=1					
604800	10080	168	7	= 1				
2419200	40320	672	28	4	= 1			
31536000	525600	8760	365	52 1/7	13 1/28	= 1		
31557600	525960	8766	365¼	52 5/28	13 5/112	1 1/1460	= 1	
31622400	527040	8784	366	52 2/7	13 1/14	1 1/365	1 1/487	= 1

The common Year is divided into Twelve Calendar Months, viz.

January	31 days	May	31 days	September	30 days.
February	28 —	June	30 —	October	31 —
March	31 —	July	31 —	November	30 —
April	30 —	August	31 —	December	31 —

The number of days in each month may be easily remembered from the following rhymes:—

30 days hath September,
April, June, and November,
February hath 28 alone,
And all the rest have 31.
But *leap year* coming once in four,
February then has one day more.

In a leap year, which happens every fourth year, February has 29 days.

The Quarterly Terms.

In England.		*In Scotland.*	
Lady-day,	25*th* March.	Candlemas,	2*nd* February.
Midsummer,	24*th* June.	Whitsunday,	15*th* May.
Michaelmas,	29*th* September.	Lammas,	1*st* August.
Christmas,	25*th* December.	Martinmas,	11*th* November.

A Brief Account of the Calendar, with the intercalations, &c.

The JULIAN OR COMMON CIVIL YEAR* is that which is employed in chronology. This is in effect a solar year, commonly containing a certain number of whole days, the odd hours and minutes being set aside to render the computation of time in the common concerns of life more easy, and consists of 365 *days*, or 13 *months*, 1 *day*; or 52 *weeks*, 1 *day*, for three years together; but every fourth year a day (or in the four years 6 hours for each year) being added to February, it then contains 366 *days*; this is called *bissextile* or *leap year*, consequently the mean Julian year will be 365 *days*, 6 *hours*.

The MEAN SOLAR, ASTRONOMICAL, TROPICAL, NATURAL, or EQUINOCTIAL YEAR is the true standard of time, and is the period of time in which the earth performs a revolution about the sun, or passes from the first point of *Aries* to the same first point of *Aries* again; and has been assumed, according to Bessel (see *Connaissance des Temps*, 1831, Additions, p. 154), equal to 365·242218 *mean solar days*=365*d*. 5*h*. 48*m*. 47·6352*s*.

Although the Julian method of intercalation is perhaps the most convenient that could be adopted; yet, as the science of astronomy advanced, the length of the astronomical year was found to be shorter than the Julian correction supposes by 11*m*. 12·3648*s*., it could not, without correction, very long answer the purpose for which it was devised, namely, that of preserving always the same interval of time between the commencement of the year and the equinox, and thus would a degree of confusion be introduced into the relative divisions of the year, and be productive of great inconvenience; at length it was discovered that an error of one day too much would take place in 129 years (for as 11*m*. 12·3648*s*. : 1 *year* :: 1*d*. : *x*); but in the time of Cæsar the length of the year was an astronomical element not very well determined. In the course of a few centuries, however, the equinox sensibly retrograded towards the beginning of the year in consequence of the precession of the equinoxes. When the Julian calendar was introduced, the equinox fell on the 25*th* of March; at the time of the Council of Nice, which was held *Anno Domini* 325, it fell on the 21*st* of March. This imperfection of the calendar was noticed as early as the time of the Venerable Bede; but the reformation of it did not take

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* The first Julian year commenced with the first of January of the 46*th* before the birth of Christ, and 708 from the foundation of the city of Rome.

place till many centuries after: *Petrus ab Alliac* and *Cusa*, two learned cardinals, not only pointed out these imperfections to the councils of Constance and Lateran, but suggested the means for its correction; and in A.D. 1474 *Pope Sixtus the IVth* engaged *Regiomontanus*, an eminent mathematician, in this task of reform, though from the circumstance of the death of *Regiomontanus* the project was not carried into effect. And when the reformation was made, in 1582, the equinox had retrograded to the 11*th* of March; therefore, in order to make the calendar more correct, *Pope Gregory the XIIIth* invited *Clavius* and *Ciaconius*, the most celebrated astronomers and mathematicians of the age, with others, to superintend the reconstruction of the calendar: they having found that by the introduction of the bissextile days, a difference had arisen of *ten days* between the calendar and actual time, owing to the odd minutes and seconds which the bissextile year occasioned the calendar to exceed the true period of the sun's progress, the *Pope* then issued a brief, in the month of March 1582, in which he abolished the use of the ancient calendar. And in order to restore the commencement of the year to the same place in the seasons that it had occupied at the time of the Council at Nice, *Gregory* directed the day following the *feast* of *St. Francis*, that is to say, the 5*th* of October, to be reckoned the 15*th* of that month. By this regulation the vernal equinox, which now happened on the 11*th* of March, was restored to the 21*st*. This last amendment of the calendar having taken place under the direction of *Pope Gregory the XIIIth*, was, out of respect to him, called the *Gregorian* or *New Style*, in opposition to the *Julian* or *Old Style*, and has been adopted by almost every Christian nation. The *Gregorian Style* was immediately acceded to by all those parts of Europe which were under the papal authority, but the Protestants adhered to the *Julian Style* with obstinate pertinacity; and the Protestants of Germany have the credit of having first rectified such inconsistency, by throwing eleven days out of their calendar in 1700; while it is worthy of remark, that the Russians, regardless of propriety, still adhere to the Julian style, and therefore, by another centurial leap-year having occurred, *viz.* in the year 1800, they now differ from us 12 days in their date of time. Now as the error of the Julian intercalation was found to amount to three days in 400 years, he ordered intercalations to be omitted on all the centenary years, excepting those which are multiples of 400. According to the Gregorian rule of intercalation, therefore, to know when it is *bissextile* or *leap year*, divide the year by 4, and the remainder shows how long it is after leap year; if nothing remains it is leap year, excepting the centurial years, which are only leap years (every four hundredth year) when divisible by 4 after suppressing the two zeros. Thus 1600, 2000, 2400, 2800, &c., are leap years, because 16, 20, 24, 28, &c., are divisible by 4; but 1700, 1800, 1900, 2100, &c., are common years, and so on, because 17, 18, 19, 21, &c., are not divisible by 4, but these would have been leap years by the Julian Calendar. As the Gregorian method of intercalation has been adopted in all Christian countries, Russia excepted, it becomes interesting to examine with what degree of accuracy it reconciles the civil with the solar year; therefore the only thing in the correction of the calendar that requires a high degree of mathematical science is the determination of the length of the astronomical year; yet this has

never been perfectly ascertained. Had the mean astronomical year been more accurately determined in the time of Julius Cæsar, the Julian correction would, probably, have superseded the necessity of the Gregorian. Although the Gregorian calendar is far preferable to the Julian, yet it is not without its defects (perhaps, as *Tycho Brahe* and *Cassini* imagine, it is impossible ever to bring the calendar to a perfect justness). According to the latest determinations of modern astronomy, the *mean solar year* consists of 365*d*. 5*h*. 48*m*. 47·6352*s*., or 365·242218*d*. Now the Gregorian rule gives 97 *intercalations* in 400 years; 400 years therefore contain $365 \times 400 + 97 = 146097$ *days*, and consequently one year contains 365·2425 *days* or 365*d*. 5*h*. 49*m*. 12*s*. This exceeds the true solar year by 24·3648 *seconds*, which amount to a day in 3546 *years*; for as 24·3648*s*. : 1 *year* :: 1*d*. : *x*. It is perhaps unnecessary to make any formal provision against an error which can only happen after so long a period of time; but as 3546 differs little from 4000, it has been proposed to correct the Gregorian rule by making the year 4000 and all its multiples common years. With this correction the rule of intercalation is as follows:— Every year, the number of which is divisible by 4, is a leap year, excepting the last year of each century, which is a leap year only when the number of the century is divisible by 4; but 4000, and its multiples, 8000, 12000, 16000, &c., are common years. Thus the uniformity of the intercalation, by continuing to depend on the number 4, is preserved; and by adopting the last correction the commencement would not vary more than a day from its present place in 31250 years. For as the Gregorian intercalation gives 97 days in 400 years, consequently in 4000 years 970 days would be intercalated; but one day is now omitted at the end of every 4000 years, therefore only 969 days are intercalated, consequently the civil year will be $365d. + \frac{969}{4000} = 365{\cdot}24225d. = 365d.\ 5h.\ 48m.\ 50{\cdot}4s.$; but this exceeds the mean solar year by 2·7648 *seconds*, and it would require 31250 *years* to make the beginning of the civil and tropical year be a day apart, for as 2·7648*s*. : 1 *year* :: 1*d*. : *x*.

From the year 1582 to 1700 the difference between the old and new style continued to be *ten days*; but 1700 being a leap year in the Julian calendar, and a common year in the Gregorian, the difference of the styles during the eighteenth century was *eleven days*. The year 1800 was also common in the new calendar, and consequently the difference in the present century is *twelve days*, and so will continue till the year 1900, and from 1900 to 2100 will be *thirteen days*, and at every centesimal year, which is not exactly divisible by 4, will be an increase of one day more, excepting 4000 and its multiples. In Great Britain the alteration from the old to the new style was for a long time successfully opposed by popular prejudice; but the inconvenience had been so generally felt in matters of history and chronology, that at length, in 1751, an act of parliament was passed in England for the adoption of the new style in the year following, in all public and legal transactions under the crown. The difference of the two styles, which then amounted to *eleven days*, was removed by ordering the day following the 2*nd* of September of the year 1752 to be accounted the 14*th* of that month, whereby that month consisted only of nineteen days; and in

order to preserve uniformity in future, the Gregorian rule of intercalation respecting the secular years was adopted.

The SIDEREAL or ASTRAL YEAR is the time elapsed from the sun's quitting a particular fixed star to its return to the same fixed star again, and it exceeds the solar year by 20*m.* 19·9561*s.*, making the sidereal year 365*d.* 6*h.* 9*m.* 7·5913*s.*; this difference is called the precession or retrograde motion of the equinoxes, by which the fixed stars gain about 50·1 *seconds* in right ascension every year; consequently the length of a sidereal year can then be determined by no method more obvious or more correct than this:—

As 360*deg.*—50·1*s.* : 365*d.* 5*h.* 48*m.* 47·6352*s.* :: 360*deg.* : 365*d.* 6*h.* 9*m.* 7·5913*s.*

The ANOMALISTIC YEAR is the interval which is occupied by the sun in passing from *apogee* to *apogee*, or from *perigee* to *perigee*; it is greater than the sidereal year by the time required to describe the annual progression or the apogee; now the progression of the apogee (its increase of longitude) being 11·8 *seconds*, therefore the anomalistic year is complete when the sun is described 360*deg.* 0*m.* 11·8*s.* Hence to find the length of an anomalistic year—

As 360*deg.* : 365*d.* 6*h.* 9*m.* 7·5913*s.* :: 360*deg.* 0*m.* 11·8*s.* : 365*d.* 6*h.* 13*m.* 54·9263*s.*

Therefore the anomalistic year is longer than the sidereal by 4*m.* 47·335*s.*, and longer than the equinoctial by 25*m.* 7·2911*s.*

Apparent or *true time* is that which is denoted by the sun-dial, from the apparent motion of the sun, and differs several minutes in certain parts of the ecliptic from the mean time, or that shown by the clock. The difference is called the equation of time, and is set down in the almanac in order to ascertain the true time. This irregularity is produced by two principal causes, *viz.* the obliquity of the ecliptic to the equator, and the eccentricity of the earth's orbit, and by the small deviations from the elliptical motion produced by the moon and planets.

A *lunar month* or *synodic revolution of the moon* is the time between two consecutive conjunctions of the moon, called the change or new moon. This period varies considerably, in consequence of the variation of the eccentricity of the moon's orbit.

A *mean lunation* is, according to Laplace, 29*d.* 12*h.* 44*m.* 2·8032*s.*, and the excess in each year is 11 *days*, from which the epact or moon's age at the commencement of any year may be found; and this is used for finding the moon's age at any time in the year.

A *day* is that portion of time in which the earth makes one complete revolution on its axis, and is measured by the interval between two successive transits of any fixed star over the same meridian. The *civil day* is reckoned from one midnight to another being divided into two periods of hours counted from one to twelve twice over among the ancient Egyptians and Romans, with modern English, Dutch, Germans, Spaniards, and Portuguese; but in astronomical calculations, the day is always supposed to begin at noon, and to end at the noon of the following day, the hours being reckoned up to 24. Therefore, if civil time be P.M., it agrees with astronomical time; but if the civil time is A.M., add 12 hours to it, and the sum will be the corresponding astronomical time of the preceding day.

A PERPETUAL ALMANAC, FOR 607 YEARS, NEW STYLE,

BY SAMUEL MAYNARD,

For finding the Day of the Month; also to find on what Day of the Week any proposed Day of the Month falls, and the contrary, from the commencement of the New Style in the year **1752** *to the year* **2359.**

TABLE I.

YEARS.							YEARS.						
B	A	G	F	E	D	C	B	A	G	F	E	D	C
	1752	1753	1754	1755		1756		2056	2057	2058	2059		2060
1757	1758	1759		1760	1761	1762	2061	2062	2063		2064	2065	2066
1763		1764	1765	1766	1767		2067		2068	2069	2070	2071	
1768	1769	1770	1771		1772	1773	2072	2073	2074	2075		2076	2077
1774	1775		1776	1777	1778	1779	2078	2079		2080	2081	2082	2083
	1780	1781	1782	1783		1784		2084	2085	2086	2087		2088
1785	1786	1787		1788	1789	1790	2089	2090	2091		2092	2093	2094
1791		1792	1793	1794	1795		2095		2096	2097	2098	2099	2100
1796	1797	1798	1799	1800	1801	1802	2101	2102	2103		2104	2105	2106
1803		1804	1805	1806	1807		2107		2108	2109	2110	2111	
1808	1809	1810	1811		1812	1813	2112	2113	2114	2115		2116	2117
1814	1815		1816	1817	1818	1819	2118	2119		2120	2121	2122	2123
	1820	1821	1822	1823		1824		2124	2125	2126	2127		2128
1825	1826	1827		1828	1829	1830	2129	2130	2131		2132	2133	2134
1831		1832	1833	1834	1835		2135		2136	2137	2138	2139	
1836	1837	1838	1839		1840	1841	2140	2141	2142	2143		2144	2145
1842	1843		1844	1845	1846	1847	2146	2147		2148	2149	2150	2151
	1848	1849	1850	1851		1852		2152	2153	2154	2155		2156
1853	1854	1855		1856	1857	1858	2157	2158	2159		2160	2161	2162
1859		1860	1861	1862	1863		2163		2164	2165	2166	2167	
1864	1865	1866	1867		1868	1869	2168	2169	2170	2171		2172	2173
1870	1871		1872	1873	1874	1875	2174	2175		2176	2177	2178	2179
	1876	1877	1878	1879		1880		2180	2181	2182	2183		2184
1881	1882	1883		1884	1885	1886	2185	2186	2187		2188	2189	2190
1887		1888	1889	1890	1891		2191		2192	2193	2194	2195	
1892	1893	1894	1895		1896	1897	2196	2197	2198	2199	2200	2201	2202
1898	1899	1900	1901	1902	1903		2203		2204	2205	2206	2207	
1904	1905	1906	1907		1908	1909	2208	2209	2210	2211		2212	2213
1910	1911		1912	1913	1914	1915	2214	2215		2216	2217	2218	2219
	1916	1917	1918	1919		1920		2220	2221	2222	2223		2224
1921	1922	1923		1924	1925	1926	2225	2226	2227		2228	2229	2230
1927		1928	1929	1930	1931		2231		2232	2233	2234	2235	
1932	1933	1934	1935		1936	1937	2236	2237	2238	2239		2240	2241
1938	1939		1940	1941	1942	1943	2242	2243		2244	2245	2246	2247
	1944	1945	1946	1947		1948		2248	2249	2250	2251		2252
1949	1950	1951		1952	1953	1954	2253	2254	2255		2256	2257	2258
1955		1956	1957	1958	1959		2259		2260	2261	2262	2263	
1960	1961	1962	1963		1964	1965	2264	2265	2266	2267		2268	2269
1966	1967		1968	1969	1970	1971	2270	2271		2272	2273	2274	2275
	1972	1973	1974	1975		1976		2276	2277	2278	2279		2280
1977	1978	1979		1980	1981	1982	2281	2282	2283		2284	2285	2286
1983		1984	1985	1986	1987		2287		2288	2289	2290	2291	
1988	1989	1990	1991		1992	1993	2292	2293	2294	2295		2296	2297
1994	1995		1996	1997	1998	1999	2298	2299	2300	2301	2302	2303	
	2000	2001	2002	2003		2004	2304	2305	2306	2307		2308	2309
2005	2006	2007		2008	2009	2010	2310	2311		2312	2313	2314	2315
2011		2012	2013	2014	2015			2316	2317	2318	2319		2320
2016	2017	2018	2019		2020	2021	2321	2322	2323		2324	2325	2326
2022	2023		2024	2025	2026	2027	2327		2328	2329	2330	2331	
	2028	2029	2030	2031		2032	2332	2333	2334	2335		2336	2337
2033	2034	2035		2036	2037	2038	2338	2339		2340	2341	2342	2343
2039		2040	2041	2042	2043			2344	2345	2346	2347		2348
2044	2045	2046	2047		2048	2049	2349	2350	2351		2352	2353	2354
2050	2051		2052	2053	2054	2055	2355		2356	2357	2358	2359	

Table II.

Days of the Month.	Days of the Week.						
1 8 15 22 29	Su.	Sa.	Fri.	Th.	We.	Tu.	Mo.
2 9 16 23 30	Mo.	Su.	Sa.	Fri.	Th.	We.	Tu.
3 10 17 24 31	Tu.	Mo.	Su.	Sa.	Fri.	Th.	We.
4 11 18 25	We.	Tu.	Mo.	Su.	Sa.	Fri.	Th.
5 12 19 26	Th.	We.	Tu.	Mo.	Su.	Sa.	Fri.
6 13 20 27	Fri.	Th.	We.	Tu.	Mo.	Su.	Sa.
7 14 21 28	Sa.	Fri.	Th.	We.	Tu.	Mo.	Su.
Jan. and Oct.	A	B	C	D	E	F	G
Feb. Mar. Nov.	D	E	F	G	A	B	C
April and July	G	A	B	C	D	E	F
May	B	C	D	E	F	G	A
June	E	F	G	A	B	C	D
August	C	D	E	F	G	A	B
Sept. and Dec.	F	G	A	B	C	D	E
Jan. Leap Year	G	A	B	C	D	E	F
Feb. Leap Year	C	D	E	F	G	A	B

Explanation of the Tables.

In *Table I.* under the word years, find the given year, above which is the dominical letter* for that year. Then in *Table II.* look for the month you want, and in a line with that month, find the same dominical letter, and in the same vertical column with that letter, and opposite the given day of the month, is the day of the week required.

Again. In every leap year for *January* and *February* only, use the same dominical letter (at the bottom of *Table II.*) corresponding to *January leap year*, and *February leap year*.

Note. In *Table I.* every blank space shows the year following, to be *leap year*.

Example. On what day of the week, did the *6th* of *February* fall in the year 1812, being *leap year*.

Here in *Table I.* find the year 1812, and in the same vertical column will be found the dominical letter D. Then look in *Table II.* and against *February leap-year*, find the same dominical letter D, and above it will be found the day of the week, opposite to the corresponding day of the month, which is *Thursday*.

Examples for Practice on the two preceding Tables.

(1.) Required the days of the week, corresponding to the dates of the following registrations. George was born on February 13*th*, 1813; Elizabeth on November 17*th*, 1816; Richard on March 10*th*, 1819; Philip on August 29*th*, 1823; and Jane on March 20*th*, 1827.

Ans. George on a Saturday; Elizabeth on a Sunday; Richard on a Wednesday; Philip on a Friday; and Jane on a Tuesday.

(2.) How many Sundays are there in the months of January, May, and December, 1846?

Ans. 4 in January, 5 in May, and 4 in December.

(3.) What day of the month did the last Friday in *January*, *February*, August, and December, fall in the year 1844?

Ans. 26*th* of *January*, 23*rd* of *February*, 30*th* of August, and 27*th* of December.

(4.) On what day of the week did the 23*rd* of March fall in the year 1789, and in what years after will the same day fall on the same date of the month?

Ans. Monday; and the same day of the week will take place, on the same date of the month, in the years 1795, 1801, 1807, 1812, 1818, 1829, 1835, 1840, 1846, 1857, 1863, and so on, with all those years in *Table I.* in the vertical columns under the Dominical Letter D.

(5.) An elderly lady, speaking of her age, says she was born in the year 1760, but does not know on what day of the month; she only recollects hearing her father say it was the second Wednesday in *February;* required the day of the month she was born. *Ans.* 13*th*.

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* The *Dominical Letter* in Chronology, properly called *Sunday Letter*, is one of the first seven letters of the alphabet A B C D E F G, and is used in Almanacs, Ephemerises, &c., to denote the Sundays throughout the year.

TABLE XVII.—*Angular Measure, or Division of the Circle.*

Every circle is supposed to be divided into 360 degrees, and the number of degrees, minutes, seconds, &c., contained in the arc of the circle comprised between the two lines forming that angle, its angular point being the centre; these divisions are, for geographical and astronomical purposes, as follows:—

The Geographical Division of any Line drawn round the Circumference of the Earth.	Diurnal Motion of the Earth reduced to Time.
60 seconds, 1 minute.....	=4 seconds.
60 minutes, 1 degree.....	=4 minutes.
15 degrees, ½ sign of the zodiac	=1 hour.
30 degrees, 1 sign of the zodiac	=2 hours.
90 degrees, 1 quadrant	=6 hours.
1 revolution, or 4 quadrants, or 360 degrees, the earth's circumference, or 12 signs, 1 great circle	=24 hours.

The zodiac is divided into 12 equal parts of 30 degrees each, called the signs of the zodiac. The zodiac is an imaginary belt encompassing the heavens, and extending about eight degrees on each side of the ecliptic, like a belt or girdle, within which the motions of all the planets are performed, except the new discovered planets, or asteroids, *Ceres* and *Pallas*.

TABLE XVIII.—*Signs of the Zodiac, and the Days on which the Sun enters them.*

THE NORTHERN CONSTELLATIONS.

♈	Aries.....	the Ram.....	appears in a line with the sun	March 20*th*.
♉	Taurus	the Bull		April 19*th*.
♊	Gemini	the Twins		May 21*st*.
♋	Cancer	the Crab.....		June 21-22*nd*.
♌	Leo	the Lion.....		July 23*rd*.
♍	Virgo.....	the Virgin		August 23*rd*.

THE SOUTHERN CONSTELLATIONS.

♎	Libra.....	the Balance	appears in a line with the sun	September 23*rd*.
♏	Scorpio	the Scorpion		October 23*rd*.
♐	Sagittarius..	the Archer.....		November 22*nd*.
♑	Capricornus.	the Goat		December 22*nd*.
♒	Aquarius ..	the Water-bearer		January 19*th*.
♓	Pisces	the Fishes.....		February 18*th*.

☉ Sol, the sun, the centre of the solar system,—95,000,000 of miles from the earth.

☽ Luna, the moon, a secondary planet attending the earth,—240,000 of miles from the earth, and its magnitude being only $\frac{1}{49}$ that of the earth.

● New moon; ☽ first quarter; ◎ or ○ full moon; ☾ last quarter

Nodes: ☊ ascending, ☋ descending.

Note. There are four cardinal points, viz. east, west, north, and south.

The east may be known by the sun's rising, and the west by the sun's setting. The top of the map of any country is always north, the right hand east.

Primary Planets.

	Mean Distance from the Sun in English Miles.		When Discovered.	Mean Distance from the Sun in English Miles.
☿ Mercury ..	37,000,000	♅	Uranus, Mar. 13, 1781	1,800,000,000
♀ Venus	68,000,000	⚳	Ceres, Jan. 1, 1801..	263,000,000
⊕ The Earth.	95,000,000	⚴	Pallas, Mar. 28, 1802	265,000,000
☽ The Moon.	95,000,000	⚵	Juno, Sept. 1, 1804..	252,000,000
♂ Mars	144,000,000	⚶	Vesta, Mar. 29, 1807	225,000,000
♃ Jupiter ..	490,000,000			
♄ Saturn ..	900,000,000			

Table XIX.—*Showing the Number of Days from any Day of one Month to the same Day of any other Month in the same Year.*

FROM ANY DAY OF	TO THE SAME DAY.												FROM ANY DAY OF
	Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	
January ...	365	31	59	90	120	151	181	212	243	273	304	334	January.
February..	334	365	28	59	89	120	150	181	212	242	273	303	February.
March.....	306	337	365	31	61	92	122	153	184	214	245	275	March.
April	275	306	334	365	30	61	91	122	153	183	214	244	April.
May	245	276	304	335	365	31	61	92	123	153	184	214	May.
June	214	245	273	304	334	365	30	61	92	122	153	183	June.
July	184	215	243	274	304	335	365	31	62	92	123	153	July.
August ...	153	184	212	243	273	304	334	365	31	61	92	122	August.
September	122	153	181	212	242	273	303	334	365	30	61	91	September.
October ...	92	123	151	182	212	243	273	304	335	365	31	61	October.
November.	61	92	120	151	181	212	242	273	304	334	365	30	November.
December.	31	62	90	121	151	182	212	243	274	304	335	365	December.

Explanation of the preceding Table.

The months counted *from any day of*, are arranged in the left-hand vertical column; those counted *to the same day*, are in the upper horizontal line; the days between those periods are found in the angle of intersection, in the same way as in a common table of multiplication. If the end of February be included between the two points of time, a day must be added in leap years. Suppose, for example, it were required to know the number of days from the 4*th* of March to the 15*th* of August:—In the left-hand vertical column marked March, and then referring to the intersection in the column under August, we find 153, which is the number of days from the 4*th* (*or any other*) day of March to the 4*th* (*or same*) day of August; but

as we want the time to the 15*th* of August, 11 days (*the difference between* 4 *and* 15) must be added to 153, which shows that 164 is the number of days between the 4*th* of March and the 15*th* of August.

Again, required the number of days between the 10*th* of October and the 3*rd* of June in the following year. Opposite to October, and under June we find 243, which is the number of days from the 10*th* of October to the 10*th* of June; but, as we sought the time to the 3*rd* only, which is 7 days earlier, we must deduct 7 from 243, leaving 236, the number of days required; and so of others.

Table XX.—*Of Number.*

12 units.....	make	1 dozen.
13 units.....	—	1 long dozen.
12 dozen	—	1 gross.
12 gross, or 144 dozen..	—	1 great gross.
20 units.....	—	1 score.
21 units.....	—	1 long score.
5 score, or 100	—	1 short hundr
6 score, or 120	—	1 long hundre
18 barrels of salt	—	1 last.
A hundred of salt.....	—	7 lasts.
12 barrels of potash, cod fish, herrings, meal, soap, pitch, and tar ..	—	1 last.
17 hundred weight of flax or feathers	—	1 last.
12 barrels of ale or beer	—	1 last.
24 barrels of gunpowder	—	1 last.
500 bricks	—	1 load.
1000 tiles	—	1 load.
12 cubic feet.....	—	1 ton of marble.
16 cubic feet.....	—	1 ton of Portland stone.
20 cubic feet.....	—	1 ton of Bath stone.
24 sheets	—	1 quire of paper or parchment.
20 sheets	—	1 quire of outside.
25 sheets	—	1 printer's quire.
21½ quire or 516 sheets.	—	1 perfect or printer's ream.
20 quires or 472 sheets..	—	1 ream of paper or parchment.
2 reams	—	1 bundle of ditto.
10 reams or 200 quires	—	1 bale.
5 dozen or 60 skins of parchment	—	1 roll.
4 pages, or 2 leaves ..	—	1 sheet of folio.
8 pages, or 4 leaves ..	—	1 sheet of quarto, or 4*to*.
16 pages, or 8 leaves ..	—	1 sheet of octavo, or 8*vo*.
24 pages, or 12 leaves ..	—	1 sheet of duodecimo, or 12*mo*.
36 pages, or 18 leaves ..	—	1 sheet of eighteens, or 18*mo*.
72 words in common law	—	1 sheet.
80 words in exchequer..	—	1 sheet.
90 words in chancery ..	—	1 sheet.
5 feet laths	—	5 score to the hundred.
4 feet laths	—	6 score to the hundred.
600*sq.ft.* of plank 1*in.* thick	—	1 load.

400*sq.ft.* of plank 1½ *in.* thick make 1 load.
300*sq.ft.* of plank 2*in.* thick.. — 1 load.
200*sq.ft.* of plank 3*in.* thick.. — 1 load.
150*sq.ft.* of plank 4*in.* thick.. — 1 load.

Deals are mostly sold by the long hundred; and those from different countries are rated in London according to the following standard.

Russian standard 12*ft.* long, 1½*in.* thick, 11*in.* broad.
Swedish standard 14*ft.* long, 3*in.* thick, 10*in.* broad
Norwegian standard 12*ft.* long, 3*in.* thick, 9*in.* broad.

Numbers often used in Calculation.

3·141592653589793 { circumf. of a circle to diam. 1; surface of a sphere to diam. 1; area of a circle to radius 1 } log. 0·497149873.

·785398163397448 area of a circle to diam. 1 log. $\bar{1}$·895,089881.
·523598775598298 solidity of a sphere to diam. 1 log. $\bar{1}$·718,998622.
12·566370614 surface of a sphere to radius 1 log. 1·099209864.
4·18879025 solidity of a sphere to rad. 1 log. 0·622088609.
57°·295779513 arc equal to radius log. 1·758122632.
206264″·8 arc equal to radius log. 5·314425133.
2·302585,092994,045684,017991,454684 Napier's log. of 10.
·434294,481903,251827,651128,918916 Reciprocal of ditto.

252·456 grains { 1 cubic inch of distilled water weighed in air at the temperature of 62° } log. 2·4021857.

62·320566 lb. avoir. = 1 cubic foot of ditto log. 1·7946314.
1·73297525 cubic inches = 1 ounce avoir. of ditto log. 0·2387924.
The square of 3·14159, &c. is = 9·869604399639 log. 0·994299745.

The side of a square { × 1·414213562373 = diam. of its circums. circle. × 1·128379167096 = diam. of an equal circle. }

The diam. of a circle { × ·886226925453 = side of an equal square. × ·707106781186 = side of inscribed square. }

·01745329251994 3 length of an arc of 1° to rad. 1 log. 8·24187736759.

Mr. William Rutherford, F.R.A.S., of the Royal Military Academy, Woolwich, has published in the Philosophical Transactions, *Part* 2. for 1841, a computation of the ratio of the diameter of a circle to its circumference (the diameter being 1) to the amazing extent of 208 places of figures, from a formula of Euler's; thus—

$\frac{\pi}{4} = 4 \tan^{-1} \frac{1}{5} - \tan^{-1} \frac{1}{70} + \tan^{-1} \frac{1}{99}$; and by obtaining the value of π he has

$\pi = 3{\cdot}14159265358979323846264338327950288419716939937510582$
$097494459230781640628620899862803482534211706798214808$
$651328230664709384460955058223172535940812848437378139$
$203863383021574739960082593125912940183280651744$;

which it is presumed, is accurate, to the last or 208*th* place of decimals inclusive.

The reciprocal of 3·14159265358979 + &c. is ·318309886183790671 + &c.

The reciprocal of ·785398163397 + &c. is 1·273239544735 + &c.

When the circumference of a circle is 1, the area is ·079577471545 947667 + &c.

The reciprocal of ·079577471 + &c. is 12·566370614359 + &c.

A TABLE OF COMPOSITE NUMBERS

From 75 to 10,000 inclusive, consisting of Three, Four, and Five Component Parts, or Factors, within the Limits of the Multiplication Table.

No.	Component Parts.	No.	Component Parts.	No.	Component Parts.	No.	Component Parts.
75	5. 5. 3	360	12.10. 3	756	12. 9. 7	1350	10. 9. 5.3
98	7. 7. 2	363	11.11. 3	768	12. 8. 8	1372	7. 7. 7.4
105	7. 5. 3	375	5. 5. 5.3	770	11.10. 7	1375	11. 5. 5.5
112	8. 7 2	378	9. 7. 6	784	8. 7. 7.2	1386	11. 9. 7.2
125	5. 5. 5	384	8. 8. 6	792	12.11. 6	1400	10.10. 7.2
126	9. 7. 2	385	11. 7. 5	800	10.10. 8	1408	11. 8. 8.2
128	8. 8. 2	392	8. 7. 7	810	10. 9. 9	1440	12.12.10
135	9. 5. 3	396	11. 9. 4	825	11. 5. 5.3	1452	12.11.11
140	10. 7. 2	400	10.10. 4	840	12.10. 7	1458	9. 9. 9.2
147	7. 7. 3	405	9. 9. 5	847	11.11. 7	1470	10. 7. 7.3
150	10. 5. 3	420	10. 7. 6	864	12. 9. 8	1485	11. 9. 5.3
154	11. 7. 2	432	12. 9. 4	875	7. 5. 5.5	1500	10.10. 5.3
160	10. 8. 2	440	11.10. 4	880	11.10. 8	1512	9. 8. 7.3
162	9. 9. 2	441	9. 7. 7	882	9. 7. 7.2	1536	8. 8. 8.3
165	11. 5. 3	448	8. 8. 7	891	11. 9. 9	1540	11.10. 7.2
168	8. 7. 3	450	10. 9. 5	896	8. 8. 7.2	1568	8. 7. 7.4
175	7. 5. 5	462	11. 7. 6	900	10.10. 9	1575	9. 7. 5.5
176	11. 8. 2	480	12.10. 4	924	12.11. 7	1584	12.12.11
180	10. 9. 2	484	11.11. 4	945	9. 7. 5.3	1600	10.10. 8.2
189	9. 7. 3	486	9. 9. 6	960	12.10. 8	1617	11. 7. 7.3
192	12. 8. 2	490	10. 7. 7	968	11.11. 8	1620	10. 9. 9.2
196	7. 7. 4	495	11. 9. 5	972	12. 9. 9	1650	11.10. 5.3
198	11. 9. 2	500	10.10. 5	980	10. 7. 7.2	1680	10. 8. 7.3
200	10.10. 2	504	9. 8. 7	990	11.10. 9	1694	11.11. 7.2
210	10. 7. 3	512	8. 8. 8	1000	10.10.10	1701	9. 9. 7.3
216	12. 9. 2	525	7. 5. 5.3	1008	12.12. 7	1715	7. 7. 7.5
220	11.10. 2	528	12.11. 4	1024	8. 8. 8.2	1728	12.12.12
224	8. 7. 4	539	11. 7. 7	1029	7. 7. 7.3	1750	10. 7. 5.5
225	9. 5. 5	540	10. 9. 6	1050	10. 7. 5.3	1760	11.10. 8.2
231	11. 7. 3	550	11.10. 5	1056	12.11. 8	1764	9. 7. 7.4
240	12.10. 2	560	10. 8. 7	1078	11. 7. 7.2	1782	11. 9. 9.2
242	11.11. 2	567	9. 9. 7	1080	12.10. 9	1792	8. 8. 7.4
243	9. 9. 3	576	12.12. 4	1089	11.11. 9	1800	10.10. 9.2
245	7. 7. 5	588	12. 7. 7	1100	11.10.10	1815	11.11. 5.3
250	10. 5. 5	594	11. 9. 6	1120	10. 8. 7.2	1848	11. 8. 7.3
252	12. 7. 3	600	10.10. 6	1125	9. 5. 5.5	1875	5. 5.5.5.3
256	8. 8. 4	605	11.11. 5	1134	9. 9. 7.2	1890	10. 9. 7.3
264	11. 6. 4	616	11. 8. 7	1152	12.12. 8	1920	12.10. 8.2
270	10. 9. 3	625	5. 5. 5.5	1155	11. 7. 5.3	1925	11. 7. 5.5
275	11. 5. 5	630	10. 9. 7	1176	8. 7. 7.3	1936	11.11. 4.4
280	10. 7. 4	640	10. 8. 8	1188	12.11. 9	1944	9. 9. 8.3
288	12.12. 2	648	9. 9. 8	1200	12.10.10	1960	10. 7. 7.4
294	7. 7. 6	660	11.10. 6	1210	11.11.10	1980	11.10. 9.2
297	11. 9. 3	672	12. 8. 7	1215	9. 9. 5.3	2000	10.10.10.2
300	10.10. 3	675	9. 5. 5.3	1225	7. 7. 5.5	2016	9. 8. 7.4
308	11. 7. 4	686	7. 7. 7.2	1232	11. 8. 7.2	2025	9. 9. 5.5
315	9. 7. 5	693	11. 9. 7	1250	10. 5. 5.5	2048	8. 8. 8.4
320	10. 8. 4	700	10.10. 7	1260	10. 9. 7.2	2058	7. 7. 7.6
324	9. 9. 4	704	11. 8. 8	1280	10. 8. 8.2	2079	11. 9. 7.3
330	11.10. 3	720	12.10. 6	1296	12.12. 9	2100	10.10. 7.3
336	12. 7. 4	726	11.11. 6	1320	12.11.10	2112	11. 8. 8.3
343	7. 7. 7	729	9. 9. 9	1323	9. 7. 7.3	2156	11. 7. 7.4
350	10. 7. 5	735	7. 7. 5.3	1331	11.11.11	2160	12.10. 9.2
352	11. 8. 4	750	10. 5. 5.3	1344	8. 8. 7.3	2178	11.11. 9.2

No.	Component Parts.	No.	Component Parts.	No.	Component Parts.	No.	Component Parts.
2187	9. 9. 9.3	3465	11. 9. 7.5	5184	9. 9. 8.8	7350	10. 7.7.5.3
2200	11.10.10.2	3500	10.10. 7.5	5250	10.7.5. 5.3	7392	12.11. 8.7
2205	9. 7. 7.5	3520	11.10. 8.4	5280	12.11.10.4	7425	11.9.5.5.3
2240	10. 8. 7.4	3528	9. 8. 7.7	5292	12. 9. 7.7	7500	10.10.5. 5.3
2250	10. 9. 5.5	3564	11. 9. 9.4	5324	11.11.11.4	7546	11.7.7.7.2
2268	9. 9. 7.4	3584	8. 8.8.7	5346	11. 9. 9.6	7560	12.10. 9.7
2304	9. 8. 8.4	3600	12.10.10.3	5376	12. 8. 8.7	7623	11.11. 9.7
2310	11.10. 7.3	3630	11.11.10.3	5390	11.10. 7.7	7680	12.10. 8.8
2352	8. 7. 7.6	3645	9. 9. 9.5	5400	10.10. 9.6	7700	11.10.10.7
2376	11. 9. 8.3	3675	7.7.5. 5.3	5445	11.11. 9.5	7744	11.11. 8.8
2400	12.10.10.2	3696	11. 8. 7.6	5488	8.7.7.7.2	7776	12. 9. 9.8
2401	7. 7. 7.7	3750	10.5.5. 5.3	5500	11.10.10.5	7840	10.8. 7.7.2
2420	11.11.10.2	3773	11. 7. 7.7	5544	11. 9. 8.7	7875	9.7. 5.5.5
2430	10. 9. 9.3	3780	10. 9. 7.6	5600	10.10. 8.7	7920	12.11.10.6
2450	10. 7. 7.5	3840	10. 8. 8.6	5625	9.5. 5.5.5	7938	9. 9.7.7.2
2464	11. 8. 7.4	3850	11.10. 7.5	5632	11. 8. 8.8	7986	11.11.11.6
2475	11. 9. 5.5	3872	11.11. 8.4	5670	10. 9. 9.7	8000	10.10.10.8
2500	10.10. 5.5	3888	9. 9. 8.6	5760	12.12.10.4	8019	11. 9. 9.9
2520	12.10. 7.3	3920	10. 8. 7.7	5775	11.7.5.5.3	8064	9.8. 8.7.2
2541	11.11. 7.3	3960	11.10. 9.4	5808	11.11. 8.6	8085	11.7.7.5.3
2560	10. 8. 8.4	3969	9. 9. 7.7	5832	9. 9. 9.8	8100	10.10. 9.9
2592	9. 9. 8.4	3993	11.11.11.3	5880	12.10. 7.7	8192	8. 8.8.4.4
2625	7.5.5.5.3	4000	10.10.10.4	5929	11.11. 7.7	8232	8.7.7.7.3
2640	11.10. 6.4	4032	9. 8. 8.7	5940	10.10. 9.6	8250	11.10.5.5.3
2646	9. 7. 7.6	4050	10. 9. 9.5	6000	10.10.10.6	8316	12.11. 9.7
2662	11.11.11.2	4096	8. 8. 8.8	6048	12. 9. 8.7	8400	12.10.10.7
2673	11. 9. 9.3	4116	12. 7. 7.7	6050	11.11.10.5	8448	12.11. 8.8
2688	8. 8. 7.6	4125	11.5.5.5.3	6075	9.9.5.5.3	8470	11.11.10.7
2695	11. 7. 7.5	4158	11. 9. 7.6	6125	7.7.5.5.5	8505	9.9. 7.5.3
2700	10.10. 9.3	4200	10.10. 7.6	6144	12. 8. 8.8	8575	7.7.7.5.5
2744	8. 7. 7.7	4224	11. 8. 8.6	6160	11.10. 8.7	8624	11. 8.7.7.2
2750	11.10. 5.5	4235	11.11. 7.5	6174	9.7.7.7.2	8640	12.10. 9.8
2772	11. 9. 7.4	4312	11. 8. 7.7	6237	11. 9. 9.7	8712	11.11. 9.8
2800	10.10. 7.4	4320	12.10. 9.4	6250	10.5.5.5.5	8748	12. 9. 9.9
2816	11. 8. 8.4	4356	11.11. 9.4	6272	8.8.7.7.2	8750	10. 7.5.5.5
2835	9. 9. 7.5	4374	9. 9. 9.6	6300	10.10. 9.7	8800	11.10.10.8
2880	12.12.10.2	4375	7.5.5.5.5	6336	11. 9. 8.8	8820	10. 9.7.7.2
2904	11.11. 8.3	4400	11.10.10.4	6400	10.10. 8.8	8910	11.10. 9.9
2916	9. 9. 9.4	4410	10. 9. 7.7	6468	12.11. 7.7	8960	10. 8.8.7.2
2940	10. 7. 7.6	4455	11. 9. 9.5	6480	10. 9. 9.8	9000	10.10.10.9
2970	11.10. 9.3	4480	10. 8. 8.7	6534	11.11. 9.6	9072	9. 9.8.7.2
3000	10.10.10.3	4500	10.10. 9.5	6561	9. 9. 9.9	9075	11.11.5. 5.3
3024	9. 8. 7.6	4536	9. 9. 8.7	6600	11.10.10.6	9216	9. 8.8.4.4
3025	11.11. 5.5	4608	9. 8. 8.8	6615	9.7.7.5.3	9240	12.11.10.7
3072	8. 8. 8.6	4620	11.10. 7.6	6655	11.11.11.5	9261	9.7.7.7.3
3080	11.10. 7.4	4704	12. 8. 7.7	6720	12.10. 8.7	9317	11.11.11.7
3087	9. 7. 7.7	4725	9.7.5.5.3	6750	10.9.5. 5.3	9375	5.5.5.5. 5.3
3125	5.5.5. 5.5	4752	11. 9. 8.6	6776	11.11. 8.7	9408	8. 8.7.7.3
3136	8. 8. 7.7	4800	12.10.10.4	6804	12. 9. 9.7	9450	10.9.7.5.3
3150	10. 9. 7.5	4802	7.7.7.7.2	6860	10.7.7.7.2	9504	12.11. 9.8
3168	11. 9. 8.4	4840	11.11.10.4	6875	11.5.5.5.5	9600	12.10.10.8
3200	10.10. 8.4	4851	11. 9. 7.7	6912	12. 9. 8.8	9604	7.7.7.7.4
3234	11. 7. 7.6	4860	10. 9. 9.6	6930	11.10. 9.7	9625	11.7.5.5.5
3240	10. 9. 9.4	4900	10.10. 7.7	7000	10.10.10.7	9680	11.11.10.8
3267	11.11. 9.3	4928	11. 8. 8.7	7040	11.10. 8.8	9702	11.9. 7.7.2
3300	11.10.10.3	4950	11.10. 9.5	7056	9.8.7.7.2	9720	12.10. 9.9
3360	12.10. 7.4	5000	10.10.10.5	7128	11. 9. 9.8	9800	10.10.7. 7.2
3375	9 5.5 5.3	5040	10. 9. 8.7	7168	8. 8.8.7.2	9801	11.11. 9.9
3388	11.11. 7.4	5082	11.11. 7.6	7200	12.10.10.6	9856	11.8. 7.4.4
3402	9. 9. 7.6	5103	9. 9. 9.7	7203	7.7.7.7.3	9900	11.10.10.9
3430	10. 7. 7.7	5120	10. 8. 8.8	7260	11.11.10.6	10000	10.10.10.10
3456	9. 8. 8.6	5145	7. 7.7.5.3	7290	10. 9. 9.9		

REDUCTION.

By reduction we change money, weights, measures, &c., out of one denomination into another, without altering the value or quantity.

To reduce greater denominations into less, multiply each greater denomination by such number as will bring it into the next less denomination, until the question be reduced to the lowest name mentioned.

If the different denominations be expressed in the question, these must be added to the denominations into which the question has been respectively reduced.

To reduce less denominations into greater, divide each less denomination by such numbers as will bring it into the next greater denomination, until the question be reduced to the denomination required. Should there be any remainder at the end of the line, it will be of the same denomination as the line from which it was reduced.

EXAMPLES.

(1) Reduce 247*l.* to shillings.
(2) Reduce 468*s.* to pence.
(3) Reduce 273*d.* to farthings.
(4) Reduce 47*l.* 13*s.* to shillings.
(5) Reduce 55*l.* 19*s.* 7*d.* to pence.
(6) Reduce 754*l.* 17*s.* $9\frac{3}{4}d.$ to farthings.

EXAMPLE (1)—Reduce 21*l.* to pence.

21
20
—
420
12
—
5040
—

The greatest name is pounds, the least is pence. The intermediate denomination is shillings. The pounds must, therefore, be first reduced to shillings by multiplying them by the number of shillings contained in one pound, *viz.* 20;—and these shillings must afterwards be reduced to pence by multiplying them by 12; because twelve pence are equal to one shilling; this last operation will give the *answer*.

(2) Reduce 12*l.* 4*s.* $6\frac{1}{2}d.$ to its lowest term.

12 . 4 . $6\frac{1}{2}$
20
—
244
12
—
2934
4
—
11738
—

In this example reduce the pounds to shillings as in *Example* 1, and to the shillings must be added the number of shillings in the question; these shillings must now be reduced to pence, taking care to add the pence which are given; and these pence must lastly be reduced to farthings by multiplying by 4, and adding the two farthings which are given.

(7) Reduce 7656*s.* to pounds.
(8) Reduce 89594*d.* to pounds.
(9) Reduce 75857*q.* to pounds.
(10) Reduce 47864*q.* to pence.
(11) Reduce 27468*d.* to shillings.
(12) Reduce 469*s.* to pence.
(13) Reduce 47864*s.* to pounds.
(14) Reduce 592*l.* 18*s.* 11¼*d.* to farthings.
(15) Reduce 616*l.* 15*s.* 4*d.* to pence.
(16) Reduce 1719*l.* 9*s.* 10½*d.* to farthings.
(17) Reduce 17563*d.* to pounds.
(18) Reduce 74*l.* 16*s.* 7*d.* to farthings.
(19) Reduce 47389675*q.* to pounds.
(20) Reduce 476*cwt.* to *qrs.* and *lbs.*
(21) In 368*gal.* 3*qts.* 1*pt.* how many pints?
(22) Reduce 60785708 farthings to pounds.
(23) In 37468*lbs.* how many *cwts?*
(24) Reduce 3729*ft.* to yards.
(25) Reduce 415*yds.* 2*ft.* 7*in.* to inches.
(26) Reduce 14 *ton,* 9*cwt.* 3*qr.* to ounces.
(27) Reduce 171 *ton,* 13*cwt.* 1*qr.* 5*lb.* 14*oz.* to drams.
(28) Reduce 76947285*oz.* to *cwts.*
(29) Reduce 5619*d.* to pounds; 17969*in.* to yards; 7768*drs.* to *lbs.*; and 8594 pints of rum to gallons.
(30) Reduce 14*yr.* 7*mo.* 2*wk.* to hours, reckoning 13 months to a year.
(31) Reduce 76*lb.* 7*oz.* 16*dwt.* 10*gr.* to grains.
(32) Reduce 17*gs.* to farthings; 1196*d.* to pounds; and 17*s.* 6½*d.* to farthings.
(33) Reduce 13*lb.* 9*oz.* 7*drs.* 2*sc.* 18*grs.* to grains.
(34) Reduce 357*yds.* 3*qr.* 2*nl.* to nails.
(35) Reduce 94764*n.* to yards.

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(3) Reduce 652 shillings to pounds.

2,0)65,2 — 32*l.* 12*s.*

Because 20 shillings are equal to one pound divide the given number of shillings by 20, and the result will be 32*l.* and a remainder 12, which will be shillings; because the dividend, or the number out of which it was left, is shillings.

(4) Reduce 5026 farthings to pounds.

4)5026
12)1256½
2,0)10,4 . 8½
£5. 4. 8½.

In this case, farthings is the lowest name mentioned, the next greater is pence, and the next to pence is shillings, and afterwards pounds. The farthings must, therefore, be reduced to pence, these pence must be reduced to shillings, and the shillings to pounds. The remainder in each line is of the same denomination as the line out of which it was left.

(36) Reduce 191*l.* 18*s.* 9¾*d.*; also 299*l.* 19*s.* 11½*d.* to farthings; and in 200456*d.* also, in 294678*q.* how many pounds?
(37) Reduce 47*a.* 3*r.* 27*per.* to perches.
(38) Reduce 16*yrs.* 5*mo.* 2*wks.* to seconds.
(39) Reduce 473628*per.* to acres.
(40) Reduce 17*yds.* 2*qr.* 1*nl.* to nails.
(41) Reduce 1620456*sec.* to years.
(42) In 1724628 pints of wine, how many pipes?
(43) Reduce to yards 4*m.* 3*fur.* 14*per.* 2*yds.*
(44) Reduce to hhds. of beer 374284*qts.*
(45) Reduce 14*hhds.* 17*gal.* 2*qts.* of ale to pints.
(46) How many years in 72468573 minutes?
(47) Reduce 4678596 farthings to guineas.
(48) Reduce 967425*dwts.* to *lbs.*
(49) Reduce to *cwts.* 19747865*drs.*
(50) Reduce to *yds.* 79679 nails.
(51) Reduce to barrels of ale 47684*qts.*
(52) Reduce 798*l.* 17*s.* 10½*d.* to farthings.
(53) Reduce 967852*grs.* to *lbs.*; 978502*drs.* to *cwts.*; and 178505*grs.* (apoth.) to *lbs.*
(54) Reduce to nails 592 *Eng. ells*, 4*qr.* 3*nl.*; 969 *Fr. ells*, 5*qr.* 1*nl.*; and 785 *Fl. ells*, 2*qr.* 2*nl.*
(55) Reduce 195*cwt.* 2*qrs.* 25*lb.* 14*dr.* to drams.
(56) Reduce 996*lb.* 14*dwts* to grains.
(57) Reduce 785*l.* 0*s.* 1¼*d.* to farthings.
(58) Reduce 1756*gs.* to pounds; 595*l.* to *gs.* and 4765*crs.* to pounds.
(59) Reduce 1352 *quarters*, 5 *bush.* 3 *pks.* 7*qts.* to quarts.
(60) In 1828, how many minutes since our Saviour was born, reckoning 365¼ days to a year?
(61) Reduce 400*gs.* to pounds.
(62) In 420 *crowns* how many pounds?
(63) Reduce 849 *nobles* to pounds.
(64) Reduce 366 *marks* to pounds.
(65) In 75*l.* 12*s.* how many quarter guineas?
(66) Reduce 369 *sovereigns* to guineas.
(67) Reduce 48*yds.* to *Fr. ells.*
(68) How many heaped gals. are there in 19*bush.* 2 *pks?*
(69) In 390 *ells Fr.* how many Eng. ells and yards?
(70) In 264397 *pecks*, how many chaldrons?
(71) What number of quarts, imperial measure, are contained in 36 *quarters*, 6*bush.* 3 *pks.* 1*gal.* 0*qts.* 1*pt.*?
(72) In 4436721 *inches*, how many *nls. qrs.* and *yds?*
(73) In 36*chal.* 7*sks.* 2*bush.* 3*pks.*, how many pecks?
(74) In 79602314*pts.* how many quarters?
(75) Reduce 6*yds.* 2*qrs.* 3*nls.* 1*in.*
(76) Reduce to the lowest name 209*qrs.* 1*pk.* 1*pt.*

COMPOUND ADDITION.

To add compound quantities, as money, weights, measures, &c.

RULE.

Write every figure under that of the same name or value. First add the least denomination, or right hand column; reduce the sum to that denomination which the next column bears, write down the remainder and carry the number obtained by reduction to the next column, add this and reduce the sum to the next greater denomination as before; thus do with every column, only the last or greatest denomination, which wants no reduction, may be added as integers.

EXAMPLES.

	£	s.	d.		£	s.	d.		Cwt.	qr.	lb.
(1)	275	16	8	(2)	562	19	$7\frac{1}{4}$	(3)	345	2	17
	350	15	7		859	15	$8\frac{3}{4}$		754	1	20
	492	9	6		979	13	$5\frac{1}{4}$		845	3	23
	795	18	9		831	14	$6\frac{3}{4}$		964	2	7
	859	17	10		498	9	$9\frac{1}{2}$		858	2	19
	998	11	11		769	11	$10\frac{3}{4}$		169	1	12
	754	10	5		957	10	$11\frac{1}{2}$		568	3	15
	937	7	4		995	16	$10\frac{1}{4}$		499	2	22

(4) Add 1592*l.* 16*s.* $9\frac{1}{2}d$; 4598*l.* 15*s.* $9\frac{3}{4}d$; 354*l.* 4*s.* $10\frac{1}{2}d$; 955*l.* 14*s.* $11\frac{1}{4}d$; 885*l.* 10*s.* $9\frac{1}{2}d$; 7556*l.* 2*s.* $4\frac{3}{4}d$; 1001*l.* 3*s.* $4\frac{1}{4}d$; 856*l.* 19*s.* $11\frac{1}{4}d$; 1954*l.* 14*s.* $8\frac{3}{4}d$.

Add 27*l.* 16*s.* $8\frac{1}{2}d$; 14*l.* 19*s.* $7\frac{3}{4}d$; 6*l.* 12*s.* $10\frac{1}{2}d$; and 3*l.* 8*s.* $3\frac{1}{4}d$.

£	s.	d.
27	16	$8\frac{1}{2}$
14	19	$7\frac{3}{4}$
6	12	$10\frac{1}{2}$
3	8	$3\frac{1}{4}$
52	17	6

Having written pounds under pounds, shillings under shillings, pence under pence, &c., as in the example, add the least denomination, viz., farthings, which are 8 farthings, and reduced to pence are 2 pence, this and the pence column added together are 30 pence, reduced to shillings are 2*s.* 6*d.* write down 6*d.* and carry 2*s.* to the shillings' column, which added together are 57*s.* reduced to pounds make 2*l.* 17*s.* write down 17*s.* and carry 2*l.* to the pounds, which added as in simple addition are 52*l.* so the whole sum is 52*l.* 17*s.* 6*d.*

So hundred weights, quarters, and pounds must be added, reducing the pounds to quarters, to be carried to quarters, the quarters to the hundred weights, to be carried to hundred weights, &c. The hundred weights when they are to be reduced to no greater name, must be added and written as in simple addition; and the same consideration may be applied to every denomination.

Numbers of different denominations cannot be added together, for 4*s.* 3*d.* added cannot make 7*s.* or 7*d.*

When there are double or triple columns, the figures therein must be written by the directions in simple addition.

(5) Add 1356*l.* 13*s.* $4\frac{1}{2}d$; 1674*l.* 13*s.* $9\frac{1}{4}d$; 959*l.* 10*s.* $9\frac{3}{4}d$; 2759*l.* 12*s.* $11\frac{1}{2}d$; 975*l.* 19*s.* $8\frac{1}{4}d$; 2592*l.* 15*s.* $7\frac{3}{4}d$; 1742*l.* 19*s.* $2\frac{1}{2}d$; 10*l.* 4*s.* 6*d*; 1982*l.* 11*s.* $11\frac{1}{2}d$.

(6) Add 757*l.* 2*s.* $10\frac{1}{2}d$; 849*l.* 19*s.* $8\frac{1}{4}d$; 17*l.* 5*s.* $6\frac{3}{4}d$; 1269*l.* 14*s.* $8\frac{1}{2}d$; 1999*l.* 13*s.* $7\frac{1}{4}d$; 299*l.* 11*s.* $4\frac{1}{4}d$; 99*l.* 5*s.* 2*d*; 959*l.* 5*s.* $11\frac{3}{4}d$; 778*l.* 16*s.* $8\frac{1}{2}d$.

(7) Add 19*l.* 5*s.* $6\frac{1}{4}d$; 3*l.* 4*s.* $4\frac{1}{2}d$; 5*l.* 2*s.* $3\frac{3}{4}d$; 11*l.* 11*s.* 1*d*; 16*l.* 0*s.* $10\frac{1}{2}d$; 21*l.* 17*s.* $8\frac{1}{4}d$; 33*l.* 19*s.* 7*d*; 49*l.* 12*s.* $5\frac{1}{2}d$; 94*l.* 17*s.* $9\frac{1}{2}d$; 87*l.* 5*s.* $3\frac{1}{4}d$; 768*l.* 15*s.* $11\frac{3}{4}d$.

(8) Add 593*l.* 19*s.* $4\frac{1}{2}d$; 855*l.* 13*s.* $6\frac{1}{4}d$; 818*l.* 1*s.* $4\frac{1}{2}d$; 952*l.* 11*s.* $7\frac{1}{4}d$; 768*l.* 17*s.* $8\frac{3}{4}d$; 587*l.* 18*s.* $9\frac{1}{2}d$; 113*l.* 12*s.* $8\frac{1}{4}d$; 916*l.* 10*s.* $0\frac{3}{4}d$; 9*l.* 19*s.* $9\frac{1}{4}d$; 100*l.* 1*s.* $11\frac{1}{2}d$; 787*l.* 14*s.* $8\frac{3}{4}d$.

(9) Add 163*cwt.* 3*qrs.* 14*lb.* 5*oz*; 562*cwt.* 1*qr.* 19*lb.* 12*oz*; 916 *cwt.* 0*qr.* 21*lb.* 17*oz*; 188*cwt.* 3*qrs.* 15*lb.* 13*oz*; 956*cwt.* 2*qrs.* 25*lb.* 11*oz*; 764*cwt.* 1*qr.* 11*lb.* 2*oz*; 981*cwt.* 3*qr.* 17*lb.* 15*oz*; 858*cwt.* 1*qr.* 22*lb.* 9*oz*; 175*cwt.* 2*qrs.* 18*lb.* 7*oz*; 459*cwt.* 1*qr.* 24*lb.* 11*oz*; 776*cwt.* 3*qrs.* 26*lb.* 14*oz*.

(10) Add 464*l.* 15*s.* $9\frac{1}{4}d$; 394*l.* 12*s.* $8\frac{3}{4}d$; 1794*l.* 17*s.* $9\frac{1}{2}d$; 847*l.* 9*s.* $10\frac{1}{2}d$; 758*l.* 13*s.* $7\frac{1}{4}d$; 124*l.* 12*s.* $6\frac{1}{4}d$; 473*l.* 18*s.* $11\frac{1}{2}d$; 967*l.* 5*s.* $2\frac{1}{4}d$; 513*l.* 7*s.* $8\frac{1}{2}d$; 838*l.* 0*s.* $7\frac{3}{4}d$; 716*l.* 14*s.* $3\frac{1}{4}d$.

(11) Add 593*yds.* 3*qr.* 2*n*; 605*yds.* 2*qr.* 1*n*; 854*yds.* 3*qr.* 2*n*; 739*yds.* 2*qr.* 3*n*; 379*yds.* 2*qr.* 1*n*; 973*yds.* 3*qr.* 1*n*; 793*yds.* 2*qr.* 3*n*; 397*yds.* 1*qr.* 3*n*; 858*yds.* 1*qr.* 1*n*; 588*yds.* 2*qr.* 1*n*; 885*yds.* 1*qr.* 3*n*; 787*yds.* 2*qr.* 2*n*; 877*yds.* 1*qr.* 3*n*; 9567*yds.* 3*qr.* 3*n*.

(12) Add 395*yds.* 2*ft.* 9*in*; 953*yds.* 1*ft.* 8*in*; 359*yds.* 2*ft.* 11*in*; 697*yds.* 1*ft.* 6*in*; 967*yds.* 2*ft.* 8*in*; 796*yds.* 1*ft.* 7*in*; 976*yds.* 2*ft.* 5*in*; 16*yds.* 2*ft.* 4*in*; 713*yds.* 0*ft.* 10*in*; 842*yds.* 2*ft.* 6*in*; 787*yds.* 1*ft.* 8*in*; 347*yds.* 2*ft.* 9*in*; 889*yds.* 2*ft.* 11*in*.

(13) Add 654*l.* 16*s.* $9\frac{1}{2}d$; 795*l.* 13*s.* $4\frac{1}{4}d$; 894*l.* 9*s.* $3\frac{3}{4}d$; 174*l.* 1*s.* $8\frac{1}{2}d$; 774*l.* 12*s.* $7\frac{1}{4}d$; 962*l.* 17*s.* $10\frac{3}{4}d$; 717*l.* 19*s.* $11\frac{1}{4}d$; 893*l.* 11*s.* $11\frac{1}{4}d$; 647*l.* 12*s.* $7\frac{1}{2}d$; 854*l.* 10*s.* $5\frac{3}{4}d$; 109*l.* 18*s.* 4*d*; 1804*l.* 12*s.* $6\frac{1}{4}d$; 905*l.* 0*s.* $5\frac{3}{4}d$.

(14) Add 513*l.* 13*s.* $8\frac{1}{2}d$; 976*l.* 19*s.* $9\frac{1}{4}d$; 387*l.* 15*s.* $7\frac{3}{4}d$; 125*l*; 9*s.* $11\frac{1}{2}d$; 665*l.* 12*s.* $5\frac{3}{4}d$; 754*l.* 16*s.* 8*d*; 392*l.* 11*s.* $11\frac{1}{4}d$; 916*l.* 15*s.* $6\frac{1}{4}d$; 138*l.* 18*s.* $4\frac{1}{2}d$; 154*l.* 10*s.* $9\frac{1}{2}d$; 999*l.* 3*s.* $2\frac{3}{4}d$; 1009*l.* 13*s.* $3\frac{1}{2}d$; 298*l.* 17*s.* $10\frac{1}{4}d$.

(15) Add 952*l.* 0*s.* $5\frac{1}{2}d$; 858*l.* 11*s.* $6\frac{1}{2}d$; 259*l.* 19*s.* $10\frac{3}{4}d$; 913*l.* 16*s.* $4\frac{1}{4}d$; 357*l.* 12*s.* $10\frac{1}{2}d$; 759*l.* 13*s.* $9\frac{1}{4}d$; 126*l.* 16*s.* $7\frac{1}{2}d$; 963*l.* 16*s.* $8\frac{3}{4}d$; 161*l.* 3*s.* 5*d*; 2957*l.* 17*s.* $8\frac{1}{4}d$; 398*l.* 18*s.* $11\frac{1}{2}d$; 579*l.* 12*s.* $4\frac{3}{4}d$; 694*l.* 15*s.* $5\frac{1}{2}d$; 1396*l.* 2*s.* 3*d*; 10*l.* 5*s.* $0\frac{3}{4}d$.

(16) Add 16*lb.* 10*oz.* 14*dwts.* 9*grs*; 13*lb.* 9*oz.* 15*dwts.* 14*grs*; 154*lb.* 8*oz.* 17*dwts.* 16*grs*; 76*lb.* 6*oz.* 12*dwts.* 19*grs*; 89*lb.* 7*oz.* 19*dwts.* 22*grs*; 9*lb.* 5*oz.* 3*dwts.* 5*grs*; 952*lb.* 4*oz.* 16*dwts.* 23*grs*; 86*l.* 11*oz.* 18*dwts.* 21*grs*; 967*lb.*

10*oz.* 19*dwts.* 23*grs*; 83*lb.* 0*oz.* 15*dwts.* 17*grs*; 951*lb.* 2*oz.* 15*dwts.* 20*grs*; 816*lb.* 9*oz.* 13*dwts.* 16*grs*; 313*lb.* 11*oz.* 17*dwts.* 22*grs*; 854*lb.* 8*oz.* 17*dwts.* 21*grs*; 1001*lb.* 5*oz.* 16*dwts.* 23*grs.*

(17) Add 171 *acres* 2 *roods* 32 *perches*; 161*a.* 1*r.* 15*p*; 91*a.* 3*r.* 39*p*; 721*a.* 1*r.* 12*p*; 82*a.* 3*r.* 36*p*; 19*a.* 0*r.* 5*p*; 121*a.* 1*r.* 31*p*; 1*a.* 2*r.* 3*p*; 19*a.* 3*r.* 27*p*; 915*a.* 1*r.* 22*p*; 81*a.* 3*r.* 26*p*; 97*a.* 3*r.* 19*p*; 93*a.* 2*r.* 2*p*; 166*a.* 0*r.* 30*p*; 66*a.* 2*r.* 33*p.*

(18) Add 375*l.* 19*s.* $5\frac{1}{2}d$; 18*l.* 5*s.* 2*d*; 9*l.* 15*s.* $9\frac{3}{4}d$; 937*l.* 9*s.* $7\frac{1}{4}d$; 789*l.* 13*s.* $8\frac{1}{2}d$; 105*l.* 16*s.* $6\frac{3}{4}d$; 700*l.* 18*s.* $11\frac{1}{4}d$; 107*l.* 9*s.* $10\frac{1}{2}d$; 919*l.* 15*s.* $2\frac{3}{4}d$; 217*l.* 17*s.* $10\frac{1}{2}d$; 798*l.* 12*s.* $4\frac{3}{4}d$; 13*l.* 2*s.* 1*d*; 166*l.* 9*s.* $4\frac{1}{2}d$; 721*l.* 16*s.* $7\frac{1}{4}d$; 227*l.* 6*s.* $3\frac{3}{4}d$.

(19) Add 197*lb.* 9*oz.* 5*drs.* 2*scru.* 15*grs*; 14*lb.* 6*oz.* 6*drs.* 1*scru.* 16*grs*; 257*lb.* 11*oz.* 7*drs.* 2*scru.* 13*grs*; 954*lb.* 10*oz.* 4*drs.* 2*scru.* 12*grs*; 845*lb.* 5*oz.* 7*drs.* 1*scru.* 13*grs*; 71*lb.* 10*oz.* 6*drs.* 2*scru.* 11*grs*; 18*lb.* 9*oz.* 3*drs.* 1*scru.* 18*grs*; 976*lb.* 11*oz.* 7*drs.* 1*scru.* 19*grs*; 752*lb.* 2*oz.* 2*drs.* 0*scru.* 17*grs*; 325*lb.* 5*oz.* 5*drs.* 2*scru.* 16*grs*; 191*lb.* 7*oz.* 5*drs.* 1*scru.* 12*grs*; 19*lb.* 10*oz.* 4*drs.* 2*scru.* 15*grs*; 175*lb.* 4*oz.* 6*drs.* 2*scru.* 18*grs*; 138*lb.* 11*oz.* 7*drs.* 1*scru.* 19*grs*; 154*lb.* 11*oz.* 7*drs.* 2*scru.* 16*grs.*

(20) Add 167*l.* 19*s.* $11\frac{1}{4}d$; 937*l.* 19*s.* 5*d*; 18*l.* 9*s.* $10\frac{1}{2}d$; 97*l.* 11*s.* $4\frac{3}{4}d$; 75*l.* 13*s.* $7\frac{1}{4}d$; 85*l.* 0*s.* $10\frac{1}{4}d$; 67*l.* 11*s.* $8\frac{1}{2}d$; 75*l.* 3*s.* $7\frac{3}{4}d$; 100*l.* 2*s.* 9*d*; 9*l.* 2*s.* $3\frac{1}{4}d$; 762*l.* 6*s.* $3\frac{1}{2}d$; 71*l.* 8*s.* $5\frac{1}{2}d$; 919*l.* 13*s.* $9\frac{1}{4}d$; 191*l.* 4*s.* $3\frac{3}{4}d$; 919*l.* 16*s.* $1\frac{1}{4}d$; 767*l.* 13*s.* $4\frac{1}{2}d$; 1*l.* 1*s.* $0\frac{1}{4}d$.

(21) Add 564 *miles* 4*fur.* 22*p*; 654*m.* 3*f.* 16*p*; 95*m.* 2*f.* 27*p*; 16*m.* 1*f.* 5*p*; 787*m.* 7*f.* 32*p*; 87*m.* 6*f.* 19*p*; 876*m.* 5*f.* 19*p*; 778*m.* 4*f.* 35*p*; 958*m.* 3*f.* 33*p*; 598*m.* 3*f.* 31*p*; 589*m.* 7*f.* 13*p*; 859*m.* 7*f.* 39*p*; 693*m.* 2*f.* 17*p*; 963*m.* 5*f.* 37*p*; 369*m.* 6*f.* 36*p*; 9567*m.* 1*f.* 32*p*; 616*m.* 3*f.* 22*p.*

(22) Add 55*hhds.* 33*gal.* 2*qt*; 61*h.* 24*g.* 1*q*; 16*h.* 3*g.* 2*q*; 161*h.* 45*g.* 1*q*; 776*h.* 51*g.* 2*q*; 677*h.* 34*g.* 3*q*; 767*h.* 47*g.* 2*q*; 616*h.* 49*g.* 2*q*; 947*h.* 56*g.* 1*q*; 497*h.* 54*g.* 3*q*; 947*h.* 19*g.* 2*q*; 794*h.* 36*g.* 2*q*; 974*h.* 13*g.* 2*q*; 479*h.* 51*g.* 1*q*; 757*h.* 22*g.* 1*q*; 876*h.* 1*g.* 1*q*; 10*h.* 0*g.* 3*q.* (Wine Measure.)

(23) Add 76*hhds.* 39*gal.* 3*qts*; 65*h.* 26*g.* 1*q*; 33*h.* 15*g.* 2*q*; 199*h.* 51*g.* 3*q*; 919*h.* 47*g.* 2*q*; 767*h.* 19*g.* 3*q*; 895*h.* 41*g.* 2*q*; 698*h.* 33*g.* 1*q*; 968*h.* 10*g.* 1*q*; 689*h.* 47*g.* 3*q*; 986*h.* 52*g.* 2*q*; 869*h.* 51*g.* 3*q*; 1904*h.* 27*g.* 2*q*; 905*h.* 38*g.* 3*q*; 590*h.* 1*g.* 1*q*; 797*h.* 3*g.* 3*q*; 977*h.* 31*g.* 1*q.* (Ale and Beer Measure.)

(24) Add 141*yrs.* 9*mo.* 2*wks.* 5 *days*; 74*yrs.* 7*mo.* 3*wks.* 6*d*; 48*yrs.* 10*mo.* 2*wks.* 4*d*; 55*yrs.* 11*mo.* 2*wks.* 6*d*; 44*yrs.* 7*mo.* 3*wks.* 4*d*; 47*yrs.* 2*mo.* 2*wks.* 2*d*; 95*yrs.* 6*mo.* 3*wks.* 5*d*; 59*yrs.* 8*mo.* 2*wks.* 3*d*; 49*yrs.* 6*mo.* 3*wks.* 4*d*; 92*yrs.*

11*mo.* 3*wks.* 6*d*; 19*yrs.* 4*mo.* 2*wks.* 4*d*; 91*yrs.* 10*mo.* 1*wk.* 5*d*; 78*yrs.* 7*mo.* 3*wks.* 9*d*; 29*yrs.* 6*mo.* 2*wks.* 3*d*; 11*yrs.* 9*mo.* 3*wks.* 2*d*; 88*yrs.* 5*mo.* 2*wks.* 5*d*; 77*yrs.* 9*mo.* 2*wks.* 6*d*; 65*yrs.* 11*mo.* 3*wks.* 6*d.* (13 months to a year.)

(25) Add 954*l.* 16*s.* $4\frac{3}{4}d$; 76*l.* 13*s.* $9\frac{1}{2}d$; 108*l.* 5*s.* $7\frac{3}{4}d$; 1295*l.* 1*s.* $6\frac{1}{4}d$; 919*l.* 9*s.* $11\frac{1}{2}d$; 1754*l.* 10*s.* $8\frac{1}{2}d$; 199*l.* 16*s.* $8\frac{1}{4}d$; 2191*l.* 4*s.* $5\frac{1}{4}d$; 350*l.* 7*s.* $6\frac{1}{2}d$; 778*l.* 6*s.* $7\frac{1}{4}d$; 457*l.* 17*s.* $9\frac{3}{4}d$; 12*l.* 19*s.* 9*d*; 139*l.* 5*s.* $8\frac{1}{4}d$; 787*l.* 4*s.* $8\frac{1}{2}d$; 953*l.* 19*s.* $11\frac{1}{2}d$; 869*l.* 13*s.* $10\frac{3}{4}d$; 1444*l.* 1*s.* $8\frac{1}{2}d$; 20*l.* 3*s.* $2\frac{1}{2}d$; 100*l.* 0*s.* $0\frac{3}{4}d$.

(26) Add 5 *days* 9*ho.* 31*min.* 42*sec*; 4*d.* 17*h.* 45*m.* 51*s*; 3*d.* 22*h.* 36*m.* 44*s*; 2*d.* 5*h.* 54*m.* 58*s*; 6*d.* 22*h.* 49*m.* 51*s*; 5*d.* 7*h.* 13*m.* 15*s*; 2*d.* 4*h.* 21*m.* 39*s*; 4*d.* 23*h.* 47*m.* 55*s*; 3*d.* 18*h.* 48*m.* 56*s*; 1*d.* 2*h.* 9*m.* 11*s*; 6*d.* 9*h.* 32*m.* 43*s*; 4*d.* 19*h.* 25*m.* 35*s*; 3*d.* 17*h.* 54*m.* 59*s*; 5*d.* 14*h.* 8*m.* 3*s*; 5*d.* 13*h.* 41*m.* 12*s*; 3*d.* 2*h.* 19*m.* 28*s*; 5*d.* 22*h.* 44*m.* 49*s*; 6*d.* 11*h.* 51*m.* 47*s*.

(27) Add 10*l.* 5*s.* 1*d*; 4*l.* 3*s.* $6\frac{1}{4}d$; 6*l.* 9*s.* $10\frac{1}{2}d$; 2*l.* 11*s.* $7\frac{1}{2}d$; 25*l.* 4*s.* 7*d*; 37*l.* 9*s.* $5\frac{1}{2}d$; 454*l.* 19*s.* $8\frac{1}{2}d$; 678*l.* 13*s.* $4\frac{1}{2}d$; 5*l.* 4*s.* $2\frac{3}{4}d$; 7*l.* 2*s.* $2\frac{1}{2}d$; 37*l.* 10*s.* $4\frac{3}{4}d$; 49*l.* 9*s.* $9\frac{1}{4}d$; 717*l.* 9*s.* $0\frac{1}{2}d$; 847*l.* 14*s.* $8\frac{3}{4}d$; 109*l.* 1*s.* 8*d*; 946*l.* 9*s.* $8\frac{1}{4}d$; 1091*l.* 11*s.* $7\frac{1}{4}d$; 1885*l.* 16*s.* $3\frac{1}{2}d$.

(28) Add 15*lb.* 9*oz.* 13*dr*; 49*lb.* 8*oz.* 12*dr*; 68*lb.* 13*oz.* 14*dr*; 95*lb.* 13*oz.* 8*dr*; 82*lb.* 6*oz.* 7*dr*; 97*lb.* 10*oz.* 12*dr*; 78*lb.* 15*oz.* 14*dr*; 8*lb.* 9*oz.* 7*dr*; 5*lb.* 11*oz.* 2*dr*; 29*lb.* 5*oz.* 13*dr*; 48*lb.* 7*oz.* 14*dr*; 19*lb.* 3*oz.* 9*dr*; 87*lb.* 11*oz.* 10*dr*; 98*lb.* 7*oz.* 5*dr*; 67*lb.* 12*oz.* 9*dr*; 88*lb.* 7*oz.* 12*dr*; 58*lb.* 15*oz.* 11*dr*; 96*lb.* 9*oz.* 8*dr*; 105*lb.* 12*oz.* 6*dr*; 86*lb.* 3*oz.* 7*dr*.

(29) Add 165*l.* 13*s.* $9\frac{1}{4}d$; 569*l.* 11*s.* $4\frac{1}{2}d$; 16*l.* 0*s.* $5\frac{1}{4}d$; 392*l.* 19*s.* $6\frac{3}{4}d$; 497*l.* 13*s.* $7\frac{1}{2}d$; 958*l.* 11*s.* $10\frac{3}{4}d$; 178*l.* 12*s.* $4\frac{1}{2}d$; 591*l.* 11*s.* $2\frac{1}{2}d$; 765*l.* 6*s.* $6\frac{1}{4}d$; 895*l.* 3*s.* $10\frac{3}{4}d$; 1564*l.* 19*s.* $9\frac{1}{2}d$; 694*l.* 7*s.* $5\frac{1}{4}d$; 567*l.* 16*s.* $8\frac{1}{2}d$; 597*l.* 14*s.* $5\frac{1}{4}d$; 109*l.* 5*s.* $8\frac{3}{4}d$; 763*l.* 9*s.* $8\frac{1}{2}d$; 657*l.* 13*s.* 9*d*; 957*l.* 11*s.* $4\frac{3}{4}d$; 1009*l.* 12*s.* $7\frac{1}{2}d$; 938*l.* 15*s.* $11\frac{1}{4}d$.

(30) Add 7968*l.* 13*s.* $4\frac{1}{2}d$; 8976*l.* 16*s.* $9\frac{1}{2}d$; 8679*l.* 15*s.* $6\frac{1}{2}d$; 9786*l.* 14*s.* $7\frac{1}{2}d$; 8769*l.* 17*s.* $9\frac{1}{4}d$; 6987*l.* 19*s.* $8\frac{1}{2}d$; 9876*l.* 13*s.* $5\frac{1}{4}d$; 6897*l.* 9*s.* $11\frac{3}{4}d$; 7698*l.* 8*s.* $7\frac{1}{2}d$; 7869*l.* 6*s.* $2\frac{1}{4}d$; 8769*l.* 17*s.* $10\frac{1}{4}d$; 9876*l.* 6*s.* $5\frac{1}{2}d$; 7968*l.* 1*s.* $11\frac{1}{4}d$; 9678*l.* 19*s.* 4*d*; 9867*l.* 7*s.* 8*d*; 7697*l.* 4*s.* $5\frac{1}{2}d$; 6879*l.* 3*s.* 5*d*; 7896*l.* 13*s.* $9\frac{3}{4}d$; 7986*l.* 19*s.* $9\frac{1}{4}d$; 6789*l.* 18*s.* $8\frac{1}{2}d$.

SUPPLEMENT TO COMPOUND ADDITION.

(1) Add into one sum the 1*st* and 20*th* examples.
(2) Add the 2*nd* and 15*th* into one sum; and also the 4*th* and 27*th*.

3) Add the 5*th* and 30*th* into one sum; the 6*th* and 29*th*; the 7*th* and 14*th*; the 8*th* and 25*th*; the 10*th* and 13*th*; the 20*th* and 8*th*.
(4) Add the 4*th* and 14*th*; the 7*th* and 15*th*; the 8*th* and 18*th*; the 30*th* and 2*nd*; and the 27*th* and 8*th*.
(5) Add the 5*th* and 25*th*; the 4*th* and 1*st*; the 7*th* and 10*th*.
(6) Add the 20*th* and 18*th* sums together; the 13*th* and 30*th*; the 29*th* and 25*th*.

COMPOUND SUBTRACTION.

To subtract compound quantities, as money, weights, or measures.

RULE.

Write the less quantity below the greater, so that each number may stand under that of the same name or value. Subtract as in simple subtraction; only where you have occasion, borrow as many as are equal to 1 in the next place, for which you must add 1 to the next lower figure.

To prove your work, add the less number and difference together, the sum will be the greater if your work be true.

EXAMPLES.

	£	*s.*	*d.*
(1) From	273	13	4
Subtract	95	10	8

	£	*s.*	*d.*
(2) From	327	13	7
Take	197	18	$10\frac{1}{2}$

(3) From 235*l.* 6*s.* $3\frac{1}{2}d.$ subtract 96*l.* 17*s.* $7\frac{3}{4}d.$
(4) From 130*l.* 13*s.* 0*d.* subtract 26*l.* 14*s.* $11\frac{1}{2}d.$
(5) Subtract 13*s.* $7\frac{1}{2}d.$ from 3*l.* 7*s.*
(6) Take 17*s.* 6*d.* from 3*l.*
(7) From 47 guineas take 47*s.*
(8) Take 13 crowns from 4*l.* 2*s.* 6*d.*
(9) Take 3 farthings from 3*l.*
(10) From 46*l.* 17*s.* 6*d.* subtract 34 guineas.

Subtract 16*l.* 14*s.* $9\frac{1}{2}d.$ from 23*l.* 8*s.* $5\frac{1}{4}d.$

£	*s.*	*d.*
23	8	$5\frac{1}{4}$.
16	14	$9\frac{1}{2}$
6	13	$7\frac{3}{4}$
23	8	$5\frac{1}{4}$

Write pounds under pounds, shillings under shillings, &c., as in the example; then the only difference between this and simple subtraction is the borrowing; for instead of 10 you must borrow as many as are equal to 1 where you carry to, so that you borrow 4 at farthings, 12 at pence, and 20 at shillings.—Pounds being the greatest name, must be subtracted as the whole numbers of integers.

(11) What is the difference between 23*l.* 7*s.* 10½*d.* and 32*l.* 6*s.* 8*d*?
(12) Borrowed 1340*l.* 16*s.* 8*d.* and paid again 568*l.* 0*s.* 10½*d.* how much remains unpaid?
(13) From 46*cwt.* 1*qr.* 7*lb.* take 29*cwt.* 3*qr.* 14*lb.*
(14) Take 27*yd.* 2*qr.* 3*n.* from 42*yd.* 1*qr.*
(15) Take 120*lb.* 8*oz.* 3*dr.* 2*sc.* 14*gr.* from 315*lb.* 4*oz.* 3*dr.*
(16) From 63*lb.* 5*oz.* 6*dwt.* subtract 36*lb.* 8*oz.* 12*dwt.* 14*gr.*
(17) From 23*a.* 3*r.* 17*p.* take 17*a.* 3*r.* 29*p.*
(18) From 1346*m.* 2*fur.* 3*p.* 4*yd.* subtract 769*m.* 6*fur.* 14*p.* 2*yd.* 2*ft.*
(19) From 127*hhd.* 34*gal.* 2*qt.* of wine, subtract 97*hhd.* 43*gal.* 2*qt.* 1*pt.*
(20) From 33*hhd.* 1*kil.* of ale, subtract 17*hhd.* 2*kil.* 1*fir.* 6*gal.*
(21) From 36*qr.* 1*bush.* of corn, subtract 19*qr.* 6*bush.* 3*pk.*
(22) Subtract 7*mo.* 2*wk.* 4*d.* 6 *h.* 23*min.* from 1 *year.* (13 months to a year.)

COMPOUND MULTIPLICATION.

To multiply compound quantities, as pounds, shillings, pence, &c.

RULE.

First multiply the least denomination, reduce the product to the next greater, and write down the remainder.—Then multiply the next denomination; to the product add the number obtained by reduction; reduce this sum to the next greater denomination, and write down the remainder as before. Thus do with every denomination, only the greatest must be multiplied as integers. (*a*)

EXAMPLES.

(1) Multiply 27*l.* 13*s.* 4*d.* By 4

Multiply 6*l.* 18*s.* 9¾*d.* By 6

(*a*) Multiply 16*l.* 17*s.* 9¾*d.* by 9.

First—Multiply the farthings, which reduced to pence are 6¾*d.* write down the ¾*d.* then multiply the pence, add 6*d.* obtained by reduction to the product, which reduced is 7*s.* 3*d.* write down 3*d.*, then multiply the shillings; add the 7 obtained by reduction to the product, the sum reduced is 8*l.* 0*s.*, write down 0*s.*, then multiply the pounds as in simple multiplication, and when the 8*l.* are added, you will have 152*l.* 0*s.* 3¾*d.* as in the example.

£	s.	d.
16	17	9¾
		9
£152	0	3¾

Thus proceed with any number not exceeding 12, taking care to reduce each product to the same name with that to which it is to be carried or added.

(2) Multiply 4*l.* 17*s.* 9½*d.* by 2, 3, 4, 5, 6, 7, 8, and 9.
(3) Multiply 24*l.* 3*s.* 10¼*d.* by 6, 7, 8, 9, 10, 11, and 12.
(4) Multiply 16*s.* 8¾*d.* by 5, 6, 7, 8, 9, 10, 11, and 12.
(5) Multiply 127*m.* 7*fur.* 11*p.* by 2, 3, 4, 7, 10, 11, and 12.

If you can take two or more such numbers that their product will be the multiplier, first multiply by one of them, and that product by another, &c. The last product will be the same as if you had multiplied by the product of all those multipliers at once. (*b*)

(6) Multiply 17*yd.* 2*ft.* 8*in.* by 16, 20, 24, 28, and 32.
(7) Multiply 7*s.* 9½*d.* by 25, 30, 35, 40, 45, and 50.
(8) Multiply 3*l.* 12*s.* 8¾*d.* by 36, 42, 48, 54, 60, and 66.
(9) Multiply 7*lb.* 7*oz.* 8*dwt.* by 49, 56, 63, 70, 77, and 84.
(10) Multiply 7*cwt.* 3*qr.* 14*lb.* 4*oz.* by 16, 28, 33, and 96.

If you cannot find numbers to produce the multiplier, take such as will come as near equal to it as you can, and to the product add or subtract, as many times the given multiplicand as the product of those numbers fall short of, or exceeds the given multiplier. (*c*)

(11) Multiply 7*l.* 11*s.* 10*d.* by 37, 51. 67, 39, 89, and 92.
(12) Multiply 156 *tons* 15*cwt.* 3*qr.* 14*lb*, 12*oz.* 13*drs.* by 43, 67, 87, and 93.

You may multiply by the compound quantity; first multiply by the least denomination, reduce the product to the next greater, then multiply by the next greater denomination, and write the product directly under the number obtained by reduc-

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(*b*) Multiply 2*l.* 14*s.* 7¼*d.* by 56.

8

21 . 16 . 10

7

152 . 17 . 10

Because 7 times 8 are 56, to multiply by 8, and that product by 7, is the same as to multiply by 56.

(*c*) Multiply 2*l.* 14*s.* 7¼*d.* by 58.

8

21 . 16 . 10

7

152 . 17 . 10

5 . 9 . 2

158 . 7 . 0½

Multiplied by 8, and that product by 7, as before, which produces 56 times, under write the given multiplicand 2*l.* 14*s.* 7¼*d.* multiplied by 2, add them together, the sum is evidently 58 times the given multiplicand.

tion, to be added thereto; reduce the sum to the next greater denomination, and so on till you have finished all the terms of the multiplicand. (*d*)

(13) Multiply 20*l*. 0*s*. 11$\frac{3}{4}$*d*. by 64, 72, 80, 88, and 96.
(14) Multiply 1*l*. 14*s*. 11$\frac{1}{2}$*d*. by 126, 252, 236, and 567.
(15) Multiply 459*lb*. 11*oz*. 15*dwt*. 23*grs*. by 58, 77, 126, and 252.

Work the following examples by the most convenient of the foregoing methods.

(16) What will 24*yds*. of cloth come to at 7*s*. 4*d*. *per yd?*
(17) What will 48*yds*. come to at 13*s*. 10$\frac{1}{2}$*d*. *per yd?*
(18) Multiply 479*lb*. 11*oz*. 7*drs*. 2*sc*. 19*grs*. by 79, 98, 57, and 143.
(19) What will 128*yds*. come to at 14*s*. 8$\frac{3}{4}$*d*. *per yd?*
(20) If 1*cwt*. cost 1*l*. 17*s*. 6$\frac{3}{4}$*d*. what will 74*cwt*. and 192*cwt*. cost?
(21) Multiply 27*yds*. 2*qr*. 3*nl*. by 54.
(22) What is the weight of 19*hhd*. of sugar, when one weighs 17*cwt*. 2*qr*. 17*lb*.*?*
(23) If 1*lb*. of tea cost 5*s*. 9*d*. what will 1*cwt*. or 112*lb*. come to at that rate?
(24) What will 17 pieces of fustian, each piece containing 28*yds*. come to, at 2*s*. 5$\frac{1}{4}$*d*. *per yd?*
(25) Multiply 394*qr*. 7*bus*. 3*pks*. 7*qts*. 1*pt*. by 93, 71, 47, and 55.

(*d*) Multiply 2*l*. 14*s*. 3$\frac{3}{4}$*d*. by 174.

£	*s*.	*d*.	
		174	
2	14	3$\frac{3}{4}$	
		4)522	
		130$\frac{1}{2}$	
		522	
		12)652$\frac{1}{2}$*d*.	
		54*s*. 4$\frac{1}{2}$*d*.	
		696	
		174	
		2,0)249,0.4$\frac{1}{2}$*d*.	
		124.10.4$\frac{1}{2}$	
		348	
£472	10	4$\frac{1}{2}$	

174 multiplied by $\frac{3}{4}$ are 522 farthings, reduced to pence are 130$\frac{1}{2}$ pence, then multiplied by 3 pence, write the product directly under 130 pence, add them together, and reduced to shillings they are 54*s*. 4*d*. then multiply by 14*s*. write the first figure of the product under the units' figure of 54, *viz*. 4, the sum reduced is 124*l*. 10*s*. then multiply by 2*l*. write the product directly under 124 and add it, the sum is 472*l*. 10*s*. 4$\frac{1}{2}$*d*. the true product.

This method not only saves the trouble of finding new multipliers, but will answer for all numbers and denominations whatever.

It is evident that any number of *yds*. *cwt*. *lbs*. will cost so many times the price of one; wherefore the price multiplied by the quantity will give the total value.

When two numbers are to be multiplied together, you may make either, the multiplier; you may either multiply the price by the quantity, or the quantity by the price.

(26) What will 51 pieces of dimity, each 28*yd.* come to at 17¾*d.* *per yd.?*

(27) What weight of sugar is there in 9*bar.* each 3*cwt.* 3*qr.* 16*lb.?*

(28) What will 4*hhd.* of treacle come to at 35*s.* 6*d.* *per cwt.* each *hhd.* containing 5*cwt.* 2*qr.?*

(29) When a pipe of wine costs 48*l.* 5*s.* 6*d.* what will 35 pipes come to at that rate?

(30) Multiply 3987*l.* 4*s.* 6½*d.* by 2; 3564*l.* 10*s.* 7½*d.* by 3; 2987*l.* 3*s.* 9¾*d.* by 5; and add the products together.

(31) Multiply 3498*l.* 2*s.* 6¾*d.* by 7; 5694*l.* 16*s.* 11¼*d.* by 8; 2691*l.* 18*s.* 11¼*d.* by 9; and add the products together.

(32) Multiply 4610*l.* 15*s.* 4*d.* by 12; 1456*l.* 16*s.* 10*d.* by 12; 2761*l.* 14*s.* 4*d.* by 6; and add the products together.

(33) Multiply 4694*l.* 12*s.* 7*d.* by 8; 2675*l.* 19*s.* 3¾*d.* by 9; 4675*l.* 17*s.* 8½*d.* by 11; 4900*l.* 0*s.* 9½*d.* by 7; and add the products together.

(34) Multiply 2648*l.* 16*s.* 8¼*d.* by 5; 2691*l.* 18*s.* 11¼*d.* by 9; 3469*l.* 15*s.* 10½*d.* by 11; 3476*l.* 17*s.* 8¾*d.* by 5; and add the products together.

(35) Multiply 3764*l.* 12*s.* 8½*d.* by 10; 5694*l.* 16*s.* 11¼*d.* by 8; 4610*l.* 15*s.* 4*d.* by 12; 4900*l.* 0*s.* 9½*d.* by 7; and add the products together.

(36) Multiply 456*l.* 12*s.* 9½*d.* by 15; 784*l.* 15*s.* 4*d.* by 18; 397*l.* 16*s.* 10*d.* by 21; and add the products together.

(37) Multiply 487*l* .16*s.* 9½*d.* by 24; 246*l.* 19*s.* 9¼*d.* by 35; 489*l.* 13*s.* 8¼*d.* by 42; and add the products together.

(38) Multiply 397*l.* 3*s.* 3*d.* by 48; 369*l.* 10*s.* 2*d.* by 54; 965*l.* 12*s.* 9¾*d.* by 63; and add the products together.

(39) Multiply 800*l.* 9*s.* 8*d.* by 72; 911*l.* 13*s.* 2¾*d.* by 84; 397*l.* 4*s.* 4¼*d.* by 96; and add the products together.

(40) Multiply 376*l.* 15*s.* 4*d.* by 121; 347*l.* 3*s.* 9*d.* by 132; 376*l.* 4*s.* 9¾*d.* by 144; and add the products together.

COMPOUND DIVISION.

To divide compound quantities, as pounds, shillings, pence, &c.

RULE.

Divide the greatest denomination as in simple division; reduce the remainder to the next less: add the given number of the same name to the product; divide the sum by the same divisor, reduce the remainder as before.—Thus proceed until you have brought it to its lowest terms, or until nothing remains.

Each quotient is of the same denomination with its respective dividend, and so is each remainder. (*a*)

(1) Divide 347*l.* 16*s.* 8*d.* by 16, 24, 96, and 87.
(2) Divide 147*l.* 18*s.* 11½*d.* by 38, 49, 128, and 236.
(3) Divide 247*cwt.* 3*qr.* 21*lb.* by 7, 33, and 148.
(4) Divide 2147*m.* 5*fur.* by 237, 896, and 7485.
(5) Divide 55 *tons* 13*lb.* by 798, 3276, 12465.

When the divisor does not exceed the number 12, you may work by short division, keeping the work in memory, and writing down only the quotient figures. (*b*)

(6) Divide 127*l.* 15*s.* 8*d.* by 2, 3, 4, 5, 6, 7, 8, and 9.
(7) Divide 146*l.* 19*s.* by 2, 7, 5, 9, 11, 6, 12, 4, and 8.
(8) Divide 387*l.* by 3, 4, 5, 6, 7, 8, 9, 10, 11, and 12.
(9) Divide 46*l.* 19*s.* 10*d.* by 10, 11, 12, 3, 9, 7, and 6.

If you can take two or more such numbers that their product will be the divisor, you may divide by one of them, and that quotient by another, &c.; the last quotient will be the same as

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(*a*) Divide 284*l.* 13*s.* 9*d.* by 34.

34)284*l.* 13*s.* 9*d.* (8*l.* 7*s.* 5½*d.*
272

12
20

34)253(7*s.*
238

15
12

34)189(5*d.*
170

19
4

34)76(2*qrs.*
68

8

284*l.* divided by 34, gives 8 in the quotient; 12*l.* remains, which, reduced to shillings and 13*s.* added, are 253*s.* this divided by 34 gives 7*s.* in the quotient; 15 shillings remain, reduced to pence and 9*d.* added are 189*d.* which divided by 34, give 5*d.* in the quotient, 19*d.* which remain reduced to farthings and divided by 34, gives 2 farthings in the quotient; so that the whole quotient is 8*l.* 7*s.* 5½*d.*—The remainder is 8 farthings.

(*b*) Divide 27*l.* 13*s.* 4*d.* by 6.

6)27.13.4

Ans. 4.12.2⅔

The work here is the same as in long division, only that you write nothing down but the quotient figures, keeping the work in your memory.

if you had divided by the product of those divisors, viz. by the original divisor. (*c*)

(10) Divide 746*l.* 8*s.* 11*d.* by 24, 42, 63, 80, and 108. (*d*)
(11) Divide 371*l.* 19*s.* by 28, 48, 70, 88, and 120.
(12) Divide 355 *ton*, 13*cwt.* 2*qr.* 13*lb.* 15*oz.* 12*dr.* by 36, 56, 72, and 132.

To multiply by a fraction.—Multiply by the numerator, and divide the product by the denominator. (*e*)

(13) Multiply 3*l.* 16*s.* 7*d.* by $\frac{2}{3}$, $\frac{3}{4}$, $\frac{1}{2}$, $\frac{5}{8}$, $\frac{3}{8}$, $\frac{9}{16}$, and $\frac{10}{24}$.

To multiply by a fraction and a whole number.—Multiply by each, and add their products together, the sum will be the product required. (*f*)

(14) Multiply 3*l.* 14*s.* $5\frac{1}{2}$*d.* by $2\frac{1}{2}$, $7\frac{3}{4}$, $6\frac{5}{8}$, $17\frac{4}{9}$, and $24\frac{9}{16}$.
(15) Divide 333 *tons*, 12*cwt.* 27*lb.* 11*oz.* 3*drs.* by 25; 422 *tons*,

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(*c*) Divide 37*l.* 14*s.* 6*d.* by 42.

6)37 . 14 . 6
7)6 . 5 . 9

Ans. 17*s.* $11\frac{1}{2}$*d.* $\frac{2}{7}$*q.*

Because 7 times 6 are 42, to divide by 6, and that quotient by 7 is the same as to divide by 42 at once; for the 7*th* part of a 6*th* part is the 42*nd* part.

(*d*) Divide 246*l.* 10*s.* 8*d.* by 240.

60)246 . 10 . 8
4) 4 . 2 . $2\frac{8}{60}=\frac{2}{15}$

Ans. £1 . 0*s.* $6\frac{1}{2}$*d.* $\frac{2}{15}$*q.*

If you have a cipher for the right-hand figure of such divisor, you may either first divide by 10, or cut the cipher off, and a figure from each dividend, and annex it again to the remainder in order for reduction.

(*e*) Multiply 7*l.* 16*s.* 8*d.* by $\frac{7}{8}$.

7 . 16 . 8
7
8)54 . 16 . 8

Ans. £6 . 17*s.* 1*d.*

Multiply by 7, and divide the product by 8, the quotient 6*l.* 17*s.* 1*d.* is the product required.

(*f*) Multiply 2*l.* 3*s.* 4*d.* by $6\frac{3}{4}$.

2 . 3 . 4
$6\frac{3}{4}$
4)6 . 10 . 0
1 . 12 . 6
13 . 0 . 0

Ans. £14 . 12*s.* 6*d.*

Multiply by $\frac{3}{4}$ and then by 6, writing these products directly one under the other, add them, and the sum is the product.

4cwt. 3*qrs.* 22*lb.* 3*oz.* by 36; 1244 *tons*, 3*qrs.* 1*lb.* 11*oz.* 2*drs.* by 42; and 6198 *tons*, 3*qrs.* 5*lb.* 7*oz.* 8*drs.* by 56.

PROMISCUOUS QUESTIONS.

Questions in Addition, Subtraction, Multiplication, Division, and Reduction.

(1) Required the sum and difference of 746*l.* 16*s.* $9\frac{1}{4}d$; and 520*l.* 19*s.* $10\frac{3}{4}d$; also of 65*cwt.* 2*qrs.* 16*lb.* 12*oz.* 9*dr*; and 78*cwt.* 2*qrs.* 8*lb.* 2*oz.* 7*dr.*

(2) Multiply the sum of 51*l.* 13*s.* $5\frac{1}{2}d$; and 320*l.* 19*s.* $9\frac{3}{4}d$. by 64.

(3) Find the difference between 199*l.* 16*s.* $9\frac{3}{4}d$; and 219*l.* 0*s.* 6*d.* and divide it by 32.

(4) Reduce 360*l.* 19*s*; and 4*l.* 19*s.* $9\frac{1}{2}d$. to the same denomination; also 4*cwt.* 2*qrs.* and 35*cwt.* 3*qrs.* 5*lb.* 6*oz.*

(5) Find the sum of 190*l.* 5*s.* $9\frac{1}{2}d$; and 1117*l.* 13*s.* $11\frac{3}{4}d$; and divide it by 84.

(6) Reduce 56 *ells E.* 4*qrs.* 2*nls.* to nails; and 61 *ells Fl.* 0*qr.* 1*nl.* to nails.

(7) Required the weight in *lbs.* of 6 *casks* of sugar, each 2*cwt.* 1*qr.* 21*lb.*

(8) Divide 3*cwt.* of tobacco amongst 62 men. (*g*)

(9) Reduce 3 miles; and 41*m.* 2*fur.* 16*p.* to the same name.

(10) Reduce 3679 poles to miles; and 161760*oz.* to *cwts.*

(11) What is the 7*th* part of a puncheon of rum?

(12) Multiply 6*l.* 16*s.* $6\frac{1}{2}d$. by 6; and divide the product by 9.

(13) Add 9790*l.* 17*s.* $10\frac{1}{4}d$; 7549*l.* 18*s.* 7*d*; 6854*l.* 15*s.* $9\frac{1}{4}d$; 8162*l.* 18*s.* 4*d*; 9971*l.* 12*s.* $6\frac{1}{4}d$; 8986*l.* 11*s.* 11*d*; 3796*l.* 14*s.* $10\frac{3}{4}d$; 9873*l.* 13*s.* 11*d*; 6984*l.* 15*s.* $10\frac{1}{2}d$; 7896*l.* 17*s.* 4*d*; 8713*l.* 18*s.* $6\frac{1}{2}d$; 9162*l.* 15*s.* 11*d*; 6397*l.* 19*s.* $10\frac{1}{4}d$; 1399*l.* 17*s.* 11*d.*

(14) Divide 3676 yards of cloth amongst 121 persons.

(15) One person is allowed 3 pints of beer per day, what quantity will serve 662 at that rate?

(16) Divide $\frac{3}{4}$ of a *cwt.* of tea equally amongst 21 persons.

(17) If 36*yds.* of cloth cost 13*l.* 19*s.* 9*d.* what is it per yard?

(18) What is the 96*th* part of 318*cwt*; and of 650*lb.* troy?

(19) What is the product of 146; and $27\frac{1}{2}$?

(*g*) The price multiplied by the quantity gives the value; therefore the value divided by the quantity gives the price; or the value divided by the price gives the quantity.

(20) Multiply 5*l.* 7*s.* $6\frac{1}{4}d.$ by $18\frac{1}{2}$, and subtract $8\frac{3}{4}d.$ from the product.

(21) Gave 22*s.* $4\frac{3}{4}d.$ for 18*lb.* of sugar, what is it *per lb.*?

(22) Add 49*l.* 17*s.* $4\frac{1}{2}d$; 86*l.* 18*s.* $9\frac{3}{4}d$; 76*l.* 12*s.* $11\frac{1}{2}d$; 84*l.* 10*s.* $10\frac{1}{2}d$; 97*l.* 17*s.* $10\frac{3}{4}d$; 19*l.* 19*s.* $9\frac{1}{2}d$; 16*l.* 17*s.* $8\frac{3}{4}d$; 97*l.* 19*s.* $11\frac{1}{2}d$; 84*l.* 6*s.* $6\frac{3}{4}d$; 45*l.* 14*s.* $5\frac{1}{2}d$; 54*l.* 9*s.* $9\frac{3}{4}d$; 67*l.* 8*s.* $8\frac{3}{4}d$; 38*l.* 7*s.* $7\frac{1}{2}d$; 4256*l.* 9*s.* $5\frac{1}{2}d$; 88*l.* 11*s.* $2\frac{1}{4}d$; 154*l.* 7*s.* $5\frac{1}{2}d$; 60*l.* 1*s.* $10\frac{3}{4}d.$

(23) What is the sum and difference of 56*l.* 5*s.* $4\frac{1}{2}d.$ and 3*l.* 15*s.* $0\frac{1}{4}d.$?

(24) A piece of Irish linen is $26\frac{1}{2}yds.$ long, how much does it come to at $22\frac{1}{2}d$; and 2*s.* $4\frac{1}{2}d.$ *per yd.*?

(25) Divide 159*l.* 19*s.* 10*d.* equally amongst 8 persons.

(26) What will 40000 bricks come to at 16*s.* 6*d.* *per* 1000?

(27) What will 3*doz.* pair of gloves come to at $22\frac{1}{2}d$; 2*s.* $2\frac{1}{4}d$; and 2*s.* $4\frac{3}{4}d.$ *per pair*?

(28) Required the value of 6 pair of shoes, at 7*s.* 9*d.* *per pair*; and 7*doz.* pair at 6*s.* 5*d.* *per pair*.

(29) If 10*doz.* of hats cost 5*l.* 15*s.* what are they *per doz.* and for each hat?

(30) Find the value of $59\frac{1}{2}$, $67\frac{1}{4}$, $91\frac{3}{4}$ gallons of rum at 16*s.* 6*d.* *per gallon.*

(31) Add 875*l.* 18*s.* $9\frac{1}{2}d$; 989*l.* 17*s.* 8*d*; 798*l.* 19*s.* $9\frac{3}{4}d$; 9*l.* 18*s.* 11*d*; 1768*l.* 15*s.* $9\frac{1}{4}d$; 585*l.* 16*s.* 8*d*; 679*l.* 14*s.* $10\frac{1}{2}d$; 898*l.* 17*s.* 7*d*; 17*l.* 5*s.* 6*d*; 199*l.* 16*s.* $9\frac{3}{4}d$; 1007*l.* 17*s.* $7\frac{1}{2}d$; 489*l.* 19*s.* 9*d*; 998*l.* 17*s.* $10\frac{3}{4}d$; 607*l.* 14*s.* 3*d*; 596*l.* 14*s.* $7\frac{1}{2}d$; 654*l.* 11*s.* $4\frac{3}{4}d$; 543*l.* 18*s.* $5\frac{1}{2}d.$

(32) Add 300*l.* 14*s.* 6*d.* to the 95*th* part of 100*l.* 5*s.* 5*d.*

(33) Multiply 4 *ells E.* 4*qr.* 2*nl.* by 7, 17, 47, and $51\frac{1}{2}$.

(34) Required the value of $29\frac{3}{4}yds.$ of fustian, at $20\frac{1}{2}d.$ 2*s.* 2*d*; and 4*s.* $9\frac{1}{4}d.$ *per yd.*

(35) Reduce 5*cwt.* 0*qr.* 13*lb.* 15*oz.* to drams; and 53601*nls.* to *Flem. ells.*

(36) What number added to 16 will make 48; and what sum added to 56*l.* 19*s.* $11\frac{3}{4}d.$ will make 76*l.* 5*s.* $10\frac{1}{2}d.$?

(37) Value 35, $37\frac{1}{2}$, $43\frac{1}{4}$, and $55\frac{3}{4}$ yards at 2*s.* 4*d.* *per yd.*

(38) Add 436*l.* 12*s.* $4\frac{3}{4}d$; 214*l.* 10*s.* 2*d*; 421*l.* 12*s.* 3*d*; 604*l.* 13*s.* 6*d*; 346*l.* 14*s.* $8\frac{1}{2}d$; 123*l.* 16*s.* 6*d*; 531*l.* 10*s.* $4\frac{1}{4}d$; 78*l.* 12*s.* 3*d*; 16*l.* 5*s.* $11\frac{1}{2}d$; 142*l.* 12*s.* $6\frac{3}{4}d$; 234*l.* 13*s.* 4*d*; 346*l.* 14*s.* $3\frac{1}{4}d$; 214*l.* 3*s.* $0\frac{1}{4}d$; 20*l.* 4*s.* 6*d*; 421*l.* 16*s.* $6\frac{1}{2}d$; 598*l.* 10*s.* $7\frac{3}{4}d$; 231*l.* 11*s.* 3*d*; 364*l.* 1*s.* $1\frac{1}{4}d$; 624*l.* 17*s.* $11\frac{1}{2}d.$

(39) Find the value of 3 knots of tape, each 36*yds.* at 1*d.* $\frac{1}{2}d$, $\frac{3}{4}d$, $\frac{1}{4}d$, $1\frac{3}{4}d.$ and $3\frac{1}{2}d.$ *per yd.*

(40) A ham weighing 15*lb.* cost 12*s.* 6*d.* what is it *per lb.*?

(41) Add 147*l.* 16*s.* 8*d*; 347 guineas; and 96 moidores.

(42) Take 127*gs.* from 200*l.*; and 27 moidores from 70*gs.*

(43) From 364 *ells Fl.* take 127 *ells E.*; and from 535 *ells Fr.* take 513*yd.* 3*qr.* 2*nl.*

(44) Take 567*l.* 16*s.* $9\frac{1}{2}d.$ from 598 moidores, 19*s.* $4\frac{1}{2}d.$

(45) A son had 500*l.* given him by his father, what will he have left after spending 65*l.* 16*s.* 9*d.*; 100*gs.*; and 50 moidores?

(46) Reduce $5\frac{3}{4}d.$; 19*s.* $9\frac{3}{4}d.$; 2*l.* 11*s.* $5\frac{1}{2}d.$; and 36*l.* to the lowest names mentioned.

(47) Reduce 5*s.* $4\frac{1}{4}d.$; 16*s.* 9*d.*; and 50*l.* 19*s.* $11\frac{3}{4}d.$ to the same name.

(48) Reduce 5*cwt.* 3*qr.* 2*lb.*; and 3 *tons*, 15*cwt.* to the same name.

(49) Reduce 56*yds.* 3*qr.* 1*nl.*; and 54 *ells E.* to the same denomination.

(50) Reduce 14*lb.* 11*oz.* 14*drs.*; and 6*oz.* 9*drs.* to the same name.

(51) Add 557*l.* 16*s.* $9\frac{1}{4}d$; 789*l.* 13*s.* $11\frac{3}{4}d$; 99*l.* 0*s.* $10\frac{1}{2}d$; 493*l.* 17*s.* $9\frac{3}{4}d$; 605*l.* 14*s.* $11\frac{1}{2}d$; 399*l.* 0*s.* $10\frac{1}{4}d$; 49*l.* 14*s.* $2\frac{1}{4}d$; 798*l.* 1*s.* $11\frac{1}{4}d$; 939*l.* 15*s.* $8\frac{3}{4}d$; 119*l.* 16*s.* $9\frac{1}{2}d$; 745*l.* 13*s.* $7\frac{3}{4}d$; 1955*l.* 14*s.* $6\frac{1}{2}d$; 9548*l.* 3*s.* $9\frac{3}{4}d$; 7556*l.* 11*s.* $9\frac{1}{4}d$; 5*l.* 16*s.* 3*d.*; 754*l.* 2*s.* $8\frac{1}{4}d$; 17*l.* 19*s.* $11\frac{3}{4}d$; 1295*l.* 13*s.* $10\frac{1}{2}d.$

(52) Reduce 240*l.* to crowns.

(53) Reduce 249*l.* to nobles.

(54) In 306 marks how many pounds?

(55) In 896*l.* how many half-crowns?

(56) In 588 quarter guineas how many pounds?

(57) Reduce 374 half guineas to sovereigns.

(58) Reduce 756 moidores to pounds.

(59) Reduce 644 dollars each 4*s.* 6*d.* to pounds.

(60) Reduce 76*l.* 19*s.* to dollars.

EXERCISES ON TABLES I. AND II.,* PAGES 43 AND 44.

(61) Required the days of the week, corresponding to the dates of the following registrations. Ann was born on December 25*th*, 1813; Augustus on May 20*th*, 1823; Sarah on January 30*th*, 1826; Newton on December 6*th*, 1832; and Mary Ann on December 26*th*, 1834.

Ans. Ann on a Saturday; Augustus on a Tuesday; Sarah on

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* The compiler of this Almanac has lately constructed and published a Chronological Table with directions and examples for finding the Dominical or Sunday letter for any year, either Old or New Style, to any date without limitation, either before or since the Christian æra; also to find the day of the week answering to any proposed day of the month, and the contrary, in any given year, past, present, or future, to infinitude, either Old or New Style; likewise the method of finding the number of days between the Old and New Style in different periods of time. This table is so convenient for its portability and comprehensiveness as to become a valuable acquisition to all persons who may be desirous of being in possession of the exact date of the month, or day

a Monday; Newton on a Thursday; and Mary Ann on a Friday.

(62) What dates of the month of December in the year 1789, were Wednesdays?

Ans. 2*nd*, 9*th*, 16*th*, 23*rd*, and 30*th*.

(63) On what days of the week does the 1*st* of *January*; 2*nd* of *February*; 3*rd* of March; and 4*th* of April fall on, in the year 1848?

Ans. Saturday, Wednesday, Friday, and Tuesday.

(64) The New Style was introduced into Great Britain by Act of Parliament on the 14*th* of September, 1752; required the day of the week?

Ans. Thursday.

(65) On what years of the 19*th* century does Midsummer day fall on a Sunday?

Ans. 1804, 1810, 1821, 1827, 1832, 1838, 1849, 1855, 1860, 1866, 1877, 1883, 1888, and 1894.

(66) Required the dominical letters for *Leap*, and Common Years, when the 1*st* of January and February falls on a Sunday?

Ans. In *Leap Years* G. C. for *January* and *February* only; and in Common Years A. and D.

SINGLE RULE OF THREE.

This is called the Rule of Three, because there are three numbers given.—It is also called the Rule of Proportion, because it teaches to find a fourth number which shall bear the same proportion to the third, that the second bears to the first.—It is sometimes called the Golden Rule, because of its excellence or usefulness, the greatest part of the mathematics depending on the doctrine of proportion.

RULE.

Write the three given numbers in a line thus, 1 : 2 :: 3, with two points between the first and second, and four between the second and third. This is called stating the question; in doing which, take care that the middle number be of the same kind with the answer, that the third be that which requires the answer, and that the first be of the same kind with the third.

Then you may observe that the first has the same relation to the second that the third has to the answer or number sought.

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of the week, of any circumstance or event in any given year, and the results are obtained by inspection only. It will also be found very convenient as a pocket perpetual almanac to the end of time.

This publication, with its introductory explanation, may be had at S. Maynard's, Mathematical and Philosophical Bookseller, No. 8, Earl's Court, Cranbourn Street, Leicester Square, London.

Multiply the second and third numbers one by the other, and divide the product by the first, and the quotient will be the answer, when the question is in direct proportion*.

Which term do you put in the middle, and why?
Which term do you put the third?
Which term do you put the first?
Which terms do you multiply together?
By which term do you divide?

EXAMPLES.

(1) If 2 hats cost 8*s.* what will 4 such hats cost?
(2) When 4*lbs.* of butter cost 6*s.* what will 8*lb.* cost?
(3) How many *yds.* of cloth can I have for 20*s.* when 4*yds.* cost 10*s.*?
(4) When 6 *eggs* cost 8*d.* how many can I have for 20*d.*?

DIRECT PROPORTION.

When less requires less, and more requires more, the question is in direct proportion. (*h*)

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* EXAMPLE.—What will 16*yds.* cost, when I have 4*yds.* for 9*s.*?

yd. s. yd. *or thus by contractions, page* 70.
4 : 9 :: 16
9
——
4)144(36*s.*
12
—
24
24
—

yds. s. yds.
4 : 9 :: 16
4 4
—
Ans. 36 *shillings.*

Because the answer is to be money, put 9*s.* for the middle term. Because 16*yds.* require the answer, put it for the third. Put 4*yds.* for the first, because the third is yards. Now you observe that 9*s.* are the value of 4*yds.* and that you want to know the value of 16*yds.* the question is therefore properly stated. Multiply the second and third terms together, divide their product by the first, and the quotient will be the answer 36*s.* The answer will always be of the same kind with the middle term.

(*h*) As soon as the pupil understands the method of stating and working the question, his attention may be directed to the nature o. proportion.

EXAMPLE.—If three men drink 12 quarts of ale in a day, how many quarts would serve 6 men a day?

m. *q.* *m.* *q.*
3 : 12 :: 6 : 24

Here less requires less and more requires more; for a less number of men require a less quantity of ale, and a greater number requires a greater quantity; again—

If 24 acres of grass be mowed by 8 men in a week, how many acres would 4 men mow in a week?

m. *a.* *m.* *a.*
8 : 24 :: 4 : 12

Here more requires more, and less requires less, for a greater number of men will mow a greater number of acres, and a less number of men will mow a less number of acres in the same time.

(5) What will 12*yds.* of cloth come to at the rate of 4*yds.* for 16*s.*?

(6) The price of 6*lb.* of tobacco is 24*s.* what is the price of 18*lb.*?

(7) When a man can travel 32 miles in 8 hours, how far would he travel in 12 hours?

(8) A person travelled 48 miles in 16 hours, how far did he travel in 12 hours?

(9) When 320*l.* will pay for 80 loads of malt, what is the price of 60 loads?

(10) The sum of 70*l.* will pay for 105 loads of meal, what quantity can I have for 210*l.* at that rate?

After the question is stated, the terms frequently want reducing.—Reduce the middle term to the lowest name or denomination mentioned.—Reduce the first and third to the same denomination. Multiply and divide as before. The quotient will be of the same denomination that the middle term was reduced to, and so will the remainder, with which proceed as in common division*.

Contractions.—When you can divide the first term and one of the others by the same number, you may substitute the quotient for those terms.

EXAMPLE.—If 6 *yards* cost 9*s.* what will 17 *yards* cost?

yds. s. yds.
6 : 9 :: 17 : 25*s.* 6*d.*

If the first and second terms be divided by 3, and the quotient substituted for 6 and 9, it will be 2 : 3 :: 17 : 25*s.* 6*d. as before.*

* EXAMPLE.—If 7 *yds.* cost 1*l.* 8*s.* what will $46\frac{3}{4}$*yds.* cost?

yd. l. s. yd.
as 7 : 1 8 :: $46\frac{3}{4}$
4 20 4
— — —
28 28 187
— — 28
—
1496
374
—
28)5236(187=9 7
—

s. l. s.

or thus by contractions.

yds. s. yds.
7 : 28 :: $46\frac{3}{4}$
4 4
—
Ans.=187*s.*=9*l.*7*s.*
—

State the question as before directed; because the middle term consists of pounds and shillings, it must be reduced to shillings, the third consisting of yards and quarters must be reduced to quarters; because the third term is reduced to quarters the first must be reduced to quarters also, that they may be both of one name. Multiply and divide as before; the quotient 187 is shillings, because the middle term was left in shillings, which, reduced to pounds, make 9*l.* 7*s.* for the answer.—If there had been a remainder, it must have been reduced to pence, and divided again as in compound division.

Sometimes it may be convenient to reduce into some intermediate term, as 3*l.* 14*s.* 6*d.* into 6 pences; 14*s.* 4*d.* into 4 pences; 3*cwt.* 2*qr.* 14*lb.* into half-quarters, &c.

To what name do you reduce the middle term?
To what name do you reduce the third?
To what name do you reduce the first?
Of what name is the quotient?
Of what name is the remainder?

(11) When 75*yds.* of cloth cost 35*l.* 17*s.* what will 315*yds.* cost at that rate?

(12) When 69*l.* 16*s.* 6*d.* pay for 84*yds.* of cloth, what will 504*yds.* cost at that rate?

(13) What will $355\frac{3}{4}$*yds.* of cloth cost when 17*yds.* cost 4*l.* 5*s.* 6*d.*?

(14) If I give 7*l.* 19*s.* 6*d.* for $19\frac{1}{4}$*yds.* of cloth, what will $692\frac{1}{2}$*yds.* cost at that rate?

(15) Gave 3*l.* 2*s.* 6*d.* for $30\frac{1}{4}$*lb.* of Epsom salts, what will 76*lb.* 5*drs.* 2*sc.* 18*grs.* cost at that rate?

(16) When 5*cwt.* 3*qr.* 16*lb.* of sugar cost 23*l.* 19*s.* $6\frac{1}{2}$*d.* what will $3\frac{1}{4}$*cwt.* cost at that rate?

(17) What will 41*cwt.* 2*qr.* 19*lb.* of gum cost at 4*s.* $6\frac{1}{2}$*d.* per *lb.*?

(18) What will 71*lb.* 13*oz.* 14*drs.* of soap cost, when $15\frac{1}{2}$*lb.* cost 14*s.* $7\frac{1}{2}$*d.*?

(19) Gave 1*l.* 19*s.* 6*d.* for 31*yds.* of muslin, what will 715*yds.* 3*qr.* 2*nl.* cost at that rate?

(20) When 18*gal.* of wine cost 16*l.* 13*s.* $4\frac{1}{2}$*d.* what will 15 *pipes*, 1*hhd.* 33*gal.* 3*qts.* 1*pt.* cost at that rate?

(21) If a bushel of oats cost 14*s.* 9*d.* what will be the value of 15*qrs.* 6*bush.* 3*pks.* 5*qts.*?

(22) When $3\frac{1}{2}$*oz.* of silver cost 19*s.* $6\frac{1}{2}$*d.* what will 55*lbs.* 9*oz.* 15*dwts.* 23*grs.* cost?

(23) What will be the value of 16 bars of gold, each 5*lb.* 6*oz.* 13*dwts.* 15*grs.* at 3*l.* 11*s.* $2\frac{1}{2}$*d. per oz.*?

(24) Required the value of 5 *tons* 19*cwt.* 2*qr.* 12*lb.* of cheese when $2\frac{3}{4}$*cwt.* cost 9*l.* 5*s.* 7*d.*

(25) Bought 29*cwt.* 3*qr.* 16*lb.* $14\frac{1}{2}$*oz.* of coffee for 319*l.* 16*s.* 7*d.* what is it for $3\frac{1}{2}$*doz. lb.*?

INVERSE PROPORTION.

When less requires more, and more requires less, the question is in Inverse Proportion. Multiply the first and second terms together, and divide their product by the third. (*i*)

(*i*) In how many days will 12 men do a piece of work, which 4 men can do in 6 days?

m. *d.* *m.* *d.*
4 : 6 :: 12 : 2 or $(4\times6)\div12=2$ days. = *Ans.*

Here less requires more, and more requires less, for a less number

(26) How many men will be able to do as much work in 14 days as 7 men can do in 28 days?
(27) In how many days ought 18 men to do a piece of work, which 34 men can do in 12 days?
(28) When a man travels 12 hours a day, he can finish a journey in 8 days, in how many days can he finish the same journey if he travel 16 hours a day?
(29) A family of 22 persons have provisions to serve them 15 days, how long would these provisions serve 6 persons?
(30) If a pasture will keep 50 sheep 1 month, or 28 days, how many will it keep 84 days?
(31) When a sack of flour sells for 48*s.* the shilling loaf weighs 2*lb.* 14*oz.* 5*dr.* what ought it to weigh when flour is at 77*s.* 6*d.* the sack?

DIRECT AND INVERSE PROPORTION, PROMISCUOUSLY.

(32) If 24*cwt.* be carried 36 miles for 3*l.* 4*s.* what must be given for the carriage of 32*cwt.* the same journey? (*j*)
(33) If 24*cwt.* be carried 36 miles for 3*l.* 4*s.* how far may 32*cwt.* be carried for the same money?
(34) If 24*cwt.* be carried 36 miles for 3*l.* 4*s.* how far may the same weight be carried for 11*l.* 4*s.*?

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of men require a greater number of days to do a piece of work, and a greater number of men will do the same work in a less number of days.

Again when wheat is 85*s.* a sack, the sixpenny loaf weighs 1*lb.* 13*oz.* 12*dr.* what ought it to weigh when wheat is 48*s.* a sack?

85s. : 1*lb.* 13*oz.* 12*dr.* :: 48*s.* : 3*lb.* 4*oz.* 10*dr.*

Here more requires less, and less requires more; for when wheat is dearer, the sixpenny loaf must be of less weight, and when wheat is cheaper, it will be of greater weight.

When a question is in inverse proportion, divide the third term and one of the others by the same number, when it can be done to shorten the operation. Or, invert the stating, by putting the term which requires the answer for the first term, then multiply and divide by the general rule.

(*j*) When there are more numbers recited in the question than are necessary, you may consider by which numbers the answer is limited and which are unnecessary in the question.

If 100*l.* gain 5*l.* interest in 12 months, what will 217*l.* gain in the same time; here, because the time is the same to both sums, the question is the same as if it had said, if 100*l.* gain 5*l.* interest in a certain time, what will 217*l.* gain in the same time, the interest being limited by the principle only.

Wherefore the stating will stand thus, 100*l.* : 5*l.* :: 217*l.* : (217×5) ÷100=217÷20=10*l.* 17*s.*

(35) If 7*cwt.* of tobacco cost 19*l.* 2*s.* 8*d.* what must be given for 46*cwt.* 14*lb.* at the same rate?

(36) Required the value of 38 casks of tallow, each 11*cwt.* 3*qr.* 14½*lb.* at 37*s.* 9¼*d. per cwt.* of 120*lb.*

(37) If the six-penny loaf weigh 4*lb.* 5*oz.* when wheat is at 12*s.* the bushel, what should the sixpenny loaf weigh when wheat is at 16*s.* per bushel?

(38) I have a right to turn 30 sheep upon a common pasture 3 months, or 84 days, how many may I keep there 63 days?

(39) If 7*yds.* of cloth, which is 2*yds.* wide, will make a cloak, how much 3 quarters wide stuff, will line it?

(40) I bought 368*yds.* of cloth for 161*l.* what must I sell 17*yds.* of it for, to gain 18*l.* 8*s.* by the whole?*

(41) A draper bought 247*yds.* of cloth for 185*l.* 5*s.* and would gain 12*l.* 7*s.* by it, he wants to know what he must have for 19¾*yds.* of that cloth.

(42) A draper bought 247*yds.* of cloth, and found that when he had sold it at the rate of 19¾*yds.* for 15*l.* 16*s.* he had gained 12*l.* 7*s.*: what did it cost him?

(43) A draper bought 247*yds.* of cloth for 185*l.* 5*s.* which he sold again at the rate of 19¾*yds.* for 15*l.* 16*s.* what did he gain by the whole?

(44) A merchant bought 480*cwt.* 3*qr.* of sugar for 1312*l.* 6*s.* and desires to know how he must sell it *per cwt.* to gain 140*l.* by the whole.

(45) A merchant sold sugar for 3*l.* 5*s.* *per cwt.* and found he had gained 140*l.* by selling 480*cwt.* 3*qr.* what did the said 480*cwt.* 3*qr.* of sugar cost him?

(46) Required the value of 4 casks, each 1*cwt.* 3*qr.* 19*lbs.* at 2*l.* 11*s.* 9*d.* *per cwt.*

(47) What will be the rent of 79*a.* 3*r.* 35*p.* of land, when 5¼ *acres* let for 25½ guineas?

(48) Bought 31 pockets of hops, each 2*cwt.* 1*qr.* 14*lbs.* at 19*l.* 8*s.* 7*d.* for 2½*cwt.*

(49) When 1*cwt.* 3*qr.* 14*lb.* of sugar cost 9*l.* 3*s.* 9½*d.* what may be had for 579*l.* 15*s.* 7¼*d.*?

(50) Bought 6½*cwt.* of coffee at 2*s.* 4*d.* *per lb.* how must I sell it *per lb.* to gain 10 guineas by the whole?

(51) If 27*cwt.* be carried 36 miles for 8*l.* 16*s.* how far may 19 *cwt.* be carried for the same money?

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* The gain upon any quantity added to the cost, gives the sum to be sold for. The cost of any article, taken from what it was sold for, gives the gain. The gain taken from the sum any article was sold for, gives the cost.

EXAMPLE.—I gave 12*d.* for a book, and sold it again for 18*d.*—This example may be varied.

(52) If 14*cwt.* be carried 36 miles for 8*l.* 16*s.* how far may $45\frac{1}{2}$ *cwt.* be carried for the same money?

(53) Find the value of 7 casks of Irish butter, each 3*qr.* $25\frac{1}{2}$*lb.* at 89*s.* $9\frac{1}{2}$*d. per cwt.*

(54) Bought at Jamaica 960*gal.* of rum for 108*l.*; freight and other expenses came to 12*l.*; duty 240*l.*; charge of the cellar and porterage 8*l.*: what must 36*gal.* of that rum be sold for to gain 36*l.* by the whole? (*k*)

(55) Required the value of 29 boxes of candles, each containing $3\frac{3}{4}$*doz.* at $6\frac{1}{4}$*d. per lb.*

(56) How many men will do as much work in 14 days as 12 men can perform in 49 days?

(57) When $2\frac{3}{4}$*cwt.* of potash cost 4*l.* 8*s.* 3*d.* what will be the value of 11 casks, weighing upon an average each 2*cwt.* 3*qr.* 27*lb.*?

(58) What is the yearly rent of $247\frac{1}{2}$ acres of land at 19*s.* $4\frac{1}{2}$*d. per acre?*

(59) What is the height of a tower which gives a shadow 68*yd.* long, when a staff 3*ft.* long gives 4*ft.* 7*in.* of a shade?

(60) A bankrupt makes a dividend of 7*s.* 9*d.* per pound, what will be received for a debt of 740*l.* 10*s.*?

(61) A gentleman spends 19*s.* 4*d.* per day, whose income is 460*l. per year*, what does he lay by at the year's end?

(62) What is the value of 12 pieces of fustian, each piece containing $28\frac{1}{2}$*yds.* at 2*s.* $3\frac{1}{2}$*d.* per yard?

(63) In what time will 327*l.* gain as much interest as 1280*l.* will gain in $7\frac{1}{2}$ months?

(64) A besieged garrison of 840 men have 14 weeks' provisions, which are required to last them 21 weeks, how many men must be turned out, and how many must remain?

(65) Find the value of 15 *tons* 3*cwt.* 2*qr.* 17*lb.* of Jamaica log-wood, when $3\frac{1}{4}$*cwt.* cost $15\frac{1}{4}$ guineas.

(66) How much tobacco at $17\frac{1}{2}$*d. per lb.* will purchase 112*lb.* of sugar at $6\frac{1}{2}$*d. per lb.?*

(67) What will 460 tons of lead come to, at 18*l.* 7*s.* 6*d. per fother* of $19\frac{1}{2}$*cwt.?*

(68) How many yards of kersey at 3*s.* 4*d. per yd.* must be given for 48*yds.* of broad cloth, at 16*s.* 10*d. per yd.?*

(69) What sum will pay the land tax for an estate of 240*l.* 16*s.* yearly rent, at 4*s. per pound?*

(70) If 14*yd.* of cloth cost 5*l.* 5*s.* what will $376\frac{3}{4}$*yd.* come to at the same rate?

(71) Required the value of 17 pieces of woollen cloth, each $43\frac{1}{2}$*yd.* at 1*l.* 8*s.* $0\frac{1}{2}$*d.* for $2\frac{3}{4}$*yd.*

(*k*) Sometimes the terms want some preparation before the general operation, as when the cost, charges, and gain are to be added together for the price to be sold for.

(72) What do 14*yd.* of cloth cost that person who paid 141*l.* 5*s.* 7½*d.* for 376¼*yd.*?

(73) If, upon a common, I have a right to keep 50 sheep 20 weeks, how long may I keep 75 there?

(74) If I buy 360*yd.* of cloth for 90*l.* what must I sell 7*yd.* of that cloth for to gain 15*l.* by the whole?

(75) What will 7 bags of cotton, weighing 32*cwt.* 3*qr.* 7*lb.* come to at 6*l.* 14*s.* *per cwt.*?

(76) What will 32*cwt.* 3*qr.* 7*lb.* of cotton come to at 15½*d.* *per lb.*?

(77) A grocer bought 46*cwt.* 3*qr.* 14*lb.* of sugar for 257*l.* 16*s.* 3*d.* what must he sell it for *per cwt.* to gain 32*l.* 4*s.* 7*d.* by the whole?

(78) A grocer sold 46*cwt.* 3*qr.* 14*lb.* of sugar for 6*l.* 3*s.* 9*d.* *per cwt.*, and gained 32*l.* 4*s.* 7*d.* by the whole, what did it cost him?

(79) A merchant bought at Jamaica 14 puncheons of rum containing 1176*gal.* for 137*l.* 4*s.*; freight cost him 8*l.* 8*s.*; loading and unloading 2*l.* 2*s.*; insurance 1*l.* 8*s.*; custom 294*l.*; and he would gain 58*l.* 16*s.*: what must he sell it at *per gal.* and what per puncheon of 82*gal.*?

(80) What is the value of 5 casks of gum, each 5*cwt.* 3*qr.* 25*lb.* at 95*s.* 6*d.* *per cwt.*?

(81) What will be the value of 37 *tons* 1*cwt.* 1*qr.* 23*lb.* of indigo, when 2¼*lb.* cost 1*l.* 7*s.* 11½*d.*?

(82) How much tea at 8*s.* 3*d.* *per lb.* must be given for 16 boxes of muscadel raisins, each 28½*lb.* at 14½*d.*?

(83) If 4 men earn 3*l.* 15*s.* in 6 days, in how many days will they earn 9*l.* 7*s.* 6*d.*?

(84) A person bought 32 pieces of cotton for 73*l.* 13*s.* 4*d.* at 20*d.* *per yard*, how many yards were there in each piece, and how many in the whole?

(85) Required the value of 9 pieces of broad cloth, each 34¼*yd.* at 19*s.* 9*d.* *per ell English.*

(86) If 6 men do a piece of work in 96 days, how many men would do the same in 12 days?

(87) A merchant bought 3600*lb.* of cotton wool, which he sold at 22*d.* *per lb.* and gained 15*l.*; what did the whole cost him?

(88) When 7¾*cwt.* of tobacco cost 2¾*d.* *per lb.* what will be the value of 51*cwt.* 3*qr.* 26¼*lb.*?

(89) If 50*l.* gain 2*l.* 10*s.* interest in 12 months, what will 375*l.* 10*s.* gain in the same time?

(90) What sum will gain 18*l.* 15*s.* 6*d.* in 12 months, when 50*l.* gains 2*l.* 10*s.* in that time?

(91) How much paper, 21 inches broad, will paper the walls of a room which measures 26*yd.* about, and 7*ft.* in height?

(92) Required the value of 479 *tons* of hay at $10\frac{1}{4}d.$ *per stone* of 16*lb.*

(93) If 3*l.* 15*s.* maintain a family of 8 persons 4 weeks, how much will maintain the same family the whole year?

(94) Find the cost of 396 tons of hay at 5*s.* $8\frac{3}{4}d.$ *per cwt.* of 120*lb.*

(95) How much incle at 2*yds.* for $1\frac{1}{2}d.$ will purchase a horse of $15\frac{1}{4}$ guineas value?

(96) What is the value of 23 packs of wool, each weighing 16*st.* at 9*s.* 4*d.* *per stone?*

(97) If a pasture containing 4*a.* 2*r.* 13*p.* keep 7 horses 3 weeks 3 days, how many will it keep 12 days?

(98) A draper buys 246*yd.* of cloth at 4*s.* 6*d.* *per yard,* which he sells again at 5*s.* 4*d.* *per yd.*; how much does he gain by the whole?

(99) If I buy sugar at 2*l.* 16*s.* 8*d.* *per cwt.* and sell it again at 3*l.* 12*s.* 4*d.* *per cwt.* what do I gain *per cent, viz.* at laying out 100*l.?*

(100) A tradesman breaking, compounds with his creditors for 13*s.* 4*d.* *per pound,* what must that creditor receive to whom he owes 1256*l.* 10*s.?*

(101) A bankrupt owes 1256*l.* 10*s.* and his effects are found to be worth no more than 837*l.* 13*s.* 4*d.* what does he pay in the pound, and what *per cent?*

COMPOUND PROPORTION.

In the double rule of three, there are five numbers given to find a sixth, which must bear the same proportion to the fourth and fifth conjointly, as the third bears to the first and second.

RULES.

To work by two or more statings.

Rule I.—Put that term of supposition which is of the same kind as the answer for the third term of the proportion, and the terms of demand for the second terms, if the statings are direct, or for the first terms of inverse; and put the remaining terms of supposition for the corresponding first or second terms; then multiply together the second and third terms for a dividend, and the first terms for a divisor; the quotient will be the answer.

Note.—A quotient is represented by the dividend put above a line, and the divisor put below it.

To work by one stating.

Rule II.—Write that number for the middle term which is of the same kind with the answer; write all the numbers after the

middle term which requires the answer; and those before it which give the middle term as an answer; and observe that the first, and first after the middle, be both of one kind; the second, and second after the middle, both of one kind, and so on. If any two terms make an inverse proportion, change their places one for the other; do the same with every inverse part; then multiply the middle term and those that follow it one into another for a dividend; multiply all the terms which stand before the middle one into another for a divisor; divide, and the quotient will be the answer.

EXAMPLES.

(1) If a man travel 240 miles in 8 days, when the days are 12 hours long, how many miles will he travel in 24 days, when the days are 16 hours long?

(2) If 46*cwt.* be carried 28 miles for 2*l.* 7*s.* what must be paid for the carriage of 184*cwt.* 84 miles?

(3) How far may 273*cwt.* be carried for 17*l.* 16*s.* when 23*cwt.* is carried 96 miles for 6*l.* 14*s.*?

EXAMPLE 1.—If 4 men work 16 roods of ditching in 3 days, how many roods will 12 men work in 6 days at the same rate?

This, like any other double rule question, may be formed into two single rule questions, thus:—If 4 men work 16 roods of ditching in 3 days, how many roods will 12 men work in the same time? which is

m. *r.* *m.* *r.*

thus stated, as 4 : 16 :: 12 : 48, therefore they will work the 48 roods in the same time, *viz.* in 3 days; then the second question will read *thus:* If 12 or any number of men work 48 roods of ditching in 3 days, how many roods will they, *viz.* the same number of men, work in 6 days?

d. *r.* *d.* *r.*

Thus stated, as 3 : 48 :: 6 : 96, *viz.* 12 men will work 96 roods in 6 days, which is the answer to the question. *Or thus:*—If 4 men work 16 roods of ditching in 3 days, how many roods will the same number of

d. *r.* *d.* *r.*

men work in 6 days; as 3 : 16 :: 6 : 32; then if 4 men work 32 roods of ditching in 6 days, how many roods will 12 men work in the same

m. *r.* *m.* *r.*

time; as 4 : 32 :: 12 : 96, as before.

To work the same question by one stating: because roods are required, write the given roods for the middle term, the men and days which work those roods for the first and second; the men and days which require

m. *d.* *r.* *m.* *d.*

the answer for the fourth and fifth thus, as 4 : 3 : 16 :: 12 : 6, then the middle term and the two that follow it, being multiplied together, and the product divided by the product of the other two, gives $(16 \times 12 \times 6) \div (4 \times 3) = 4 \times 4 \times 6 = 96$ roods for the answer.

When you work by two statings, you have nothing more to consider than what the single rule of three requires to each stating.

When you work by only one stating, it will perhaps be most convenient

(4) If 24 sheep be at grass 8 weeks for 3*l.* 4*s.* how many sheep may go in the same pasture 13 weeks for 9*l.* 16*s.*?

(5) How many men will do as much work in 24 days, when the days are 16 hours long, as 18 men will perform in 36 days, when the days are but 12 hours long?

(6) If 7*l.* 16*s.* be sufficient to maintain a family of 8 persons 7 weeks, how much will maintain a family of 12 persons the whole year?

(7) If 100*l.* gain 5*l.* interest in 12 months, what will 347*l.* 15*s.* gain in 21 months?

(8) How far may 126*cwt.* 3*qr.* 14*lb.* be carried for 27*l.* 14*s.* 6*d.* when the carriage of $7\frac{1}{2}$*cwt.* 30 miles cost 2*l.* 2*s.* 6*d.*?

(9) How many persons will 86*l.* 18*s.* $3\frac{1}{2}$*d.* maintain 1 year, when 7*l.* 16*s.* will maintain 8 persons 7 weeks?

(10) How long will 86*l.* 18*s.* $3\frac{1}{2}$*d.* maintain a family of 12 persons, when 7*l.* 16*s.* will maintain 8 persons 7 weeks?

(11) If 100*l.* gain 4*l.* 10*s.* interest in 12 months, how much money will gain 17*l.* 14*s.* $5\frac{1}{2}$*d.* in 21 months?

(12) If 100*l.* will gain 4*l.* 10*s.* interest in 12 months, in what time will 218*l.* 14*s.* gain 17*l.* 14*s.* $5\frac{1}{2}$*d.* interest?

(13) If a man travel 120 miles in 4 days, when the days are 12 hours long, in how many days will he travel 960 miles, when the days are 16 hours long?

(14) If 26*cwt.* be carried 50 miles for 18*l.* how far may 84*cwt.* 3*qr.* 14*lb.* be carried for 56*l.* 10*s.*?

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to consider the inverse part, and to change their place one for the other, as in the following example, viz.

If 4 men work 6 roods of ditching in 3 days, how many men will work 96 roods in 6 days? Stated by the foregoing directions will stand thus, 16 : 3 : 4 :: 96 : 6, but here I observe that more days will require fewer men, wherefore the days make an inverse proportion, and I change their places thus, 16 : 6 : 4 :: 96 : 3, then multiply the three last terms together for a dividend, and the two first for a divisor, &c. $(4 \times 96 \times 3) \div (16 \times 6) = 4 \times 3 = 12$ men for the answer, which corresponds with the former question.

Again, by Rule I.

EXAMPLE 2.—If 4 men build a wall 2 feet thick, 6 feet high, and 21 yards long in 6 days, how many men will build a wall 3 feet thick, 9 feet high, and 189 yards long in 3 days at the same rate?

$$\left.\begin{array}{rcl} 2ft.\ thick & : & 3ft.\ thick \\ 6ft.\ high & : & 9ft.\ high \\ 21yds.\ long & : & 189yds.\ long \\ 3\ days & : & 6\ days \end{array}\right\} :: 4\ men.$$

$$\text{Then } \frac{\cancel{3} \times 9 \times 189 \times \cancel{6} \times 4}{2 \times \cancel{6} \times 21 \times \cancel{3}} = \frac{9 \times \cancel{189} \times \cancel{4}}{\cancel{7} \times \cancel{21}} = 9 \times 9 \times 2 = 162\ men = Ans.$$

(15) If 14 men reap 8 acres of corn in 6 days, how many acres will 30 men reap in 14 days?

(16) How many men will reap 68 acres of corn in 14 days, when 14 men will reap 8 acres in 6 days?

(17) If 7 oxen be at grass 4 weeks for 1*l.* 8*s.* how many oxen may be in the same pasture 12 weeks for 19*l.* 8*s.*?

(18) If six men mow 24 acres of grass in 8 days, in how many days will 24 men mow 288 acres?

(19) If 6 men mow 24 acres of grass in 8 days, how many acres will 24 men mow in 24 days?

(20) If 6 men mow 24 acres of grass in 8 days, how many men will mow 288 acres in 24 days?

(21) If 12 men dig a trench 124*yd.* long, 4*ft.* wide, and 2*ft.* deep, in 6 days, what length of another trench 7*ft.* wide, and 4*ft.* deep will 45 men dig in 21 days?

(22) If 14 men dig a trench 120*yd.* long, 4*ft.* wide, and 2*ft.* deep, in 6 days, how many men will dig another trench 420*yd.* long, 7*ft.* wide, and 4*ft.* deep in 21 days?

(23) If the 4*d.* loaf weigh 3*lb.* 4*oz.* when wheat is at 12*s.* *per* bushel, what should the 12*d.* loaf weigh when wheat is at 16*s.* the bushel?

(24) If 17*yd.* of cloth, which is 26*in.* wide, cost 3*l.* 15*s.* what will 36*yd.* of cloth of equal goodness with the former, and 32*in.* wide cost?

(25) If grass for 14 oxen 6*wks.* cost 12*gs.* how many oxen may be kept in as good pasturage 13*wks.* for 52*l.* 13*s.*?

(26) What must be paid for grass for 27 oxen 13*wks.* at the rate of 12*gs.* for 14 oxen 6*wks.*?

(27) If 120 stones, each a foot square, will pave a court, how many stones, each 9*in.* long, and 6*in.* broad, would pave the same?

(28) If 840 stones, each 3*ft.* long and 2*ft.* broad, will pave an area, how many stones, each 18*in.* long and 9*in.* broad, would pave the same?

(29) A hay-mow 7*yd.* long, $3\frac{1}{2}$*yd.* broad, and 4*yd.* high was sold for 22*l.* 1*s.* and if another mow 12*yd.* long, $7\frac{1}{2}$*yd.* broad, and $3\frac{3}{4}$*yd.* high be valued by the former, what will it come to?

(30) What length of a field 210*yd.* broad, and which is worth 28*l.* *per acre*, must be given for another field 860*yd.* long and 120*yd.* broad, which is worth 40*l.* *per acre?*

(31) If an iron bar 2*ft.* long, 3*in.* broad, and 1*in.* thick, weigh 18*lb.* what will be the weight of another bar of iron which is 7*ft.* long, 6*in.* broad, and $3\frac{1}{2}$*in.* thick?

(32) If, when wine is valued at 40*l.* *per pipe*, 14*l.* worth be sufficient for 8 persons 36 weeks, how much in value will suffice 30 persons the whole year, when the same wine is valued at 60*l.* *per pipe?*

(33) If the flooring of a room, which is 7*yd.* long and $4\frac{1}{2}$*yd.* broad cost 2*l.* 6*s.* 6*d.* what will be the expense of flooring another room 9*yd.* long, and $6\frac{3}{4}$*yd.* broad, in the same manner?

(34) How many men will build a wall 240*yd.* long, 6*ft.* high, and 3*ft.* thick, in 8 days, when 7 men can build another wall 40*yd.* long, 4*ft.* high, and 2*ft.* thick in 32 days?

PRACTICE.

THE rules of practice are expeditious methods of calculating the value of any given number of yards, pounds, hundred weights, &c. having the price of one given. This is generally done by taking aliquot or even parts, as in the following rules:

A Table of the Aliquot parts of Money.

Of a Pound.									Of a Shilling.	
s.	*d.*	*l.*	*s.*	*d.*	*l.*	*d.*	*l.*		*d.*	*s.*
10	0	is $\frac{1}{2}$	1	3	is $\frac{1}{16}$	3	is $\frac{1}{80}$		6	is $\frac{1}{2}$
6	8	is $\frac{1}{3}$	1	0	is $\frac{1}{20}$	$2\frac{1}{2}$	is $\frac{1}{96}$		4	is $\frac{1}{3}$
5	0	is $\frac{1}{4}$		10	is $\frac{1}{24}$	2	is $\frac{1}{120}$		3	is $\frac{1}{4}$
4	0	is $\frac{1}{5}$		8	is $\frac{1}{30}$	$1\frac{1}{2}$	is $\frac{1}{160}$		2	is $\frac{1}{6}$
3	4	is $\frac{1}{6}$		$7\frac{1}{2}$	is $\frac{1}{32}$	$1\frac{1}{4}$	is $\frac{1}{192}$		$1\frac{1}{2}$	is $\frac{1}{8}$
2	6	is $\frac{1}{8}$		6	is $\frac{1}{40}$	1	is $\frac{1}{240}$		1	is $\frac{1}{12}$
2	0	is $\frac{1}{10}$		5	is $\frac{1}{48}$	$\frac{3}{4}$	is $\frac{1}{320}$		$\frac{3}{4}$	is $\frac{1}{16}$
1	8	is $\frac{1}{12}$		4	is $\frac{1}{60}$	$\frac{1}{2}$	is $\frac{1}{480}$		$\frac{1}{2}$	is $\frac{1}{24}$
1	4	is $\frac{1}{15}$		$3\frac{3}{4}$	is $\frac{1}{64}$	$\frac{1}{4}$	is $\frac{1}{960}$		$\frac{1}{4}$	is $\frac{1}{48}$

CASE I. (*a*)

If the price be the aliquot or even part of a shilling, the like part of the quantity will be the answer, in shillings.

EXAMPLES.

(1) What will 327*yd.* come to at 6, 4, 3, 2, $1\frac{1}{2}$, and 1*d. per yard?*
(2) What will 1748*cwt.* come to at 6, 4, 3, 2, $1\frac{1}{2}$ and 1*d. per cwt.?*

(*a*) What will 746 yards come to at 4*d. per yard?*

4*d.*	$\frac{1}{3}$	746
	2,0	24,8 . 8*d.*

Ans. £12 . 8*s.* 8*d.*

746 yards at 4*d.* each will cost 746 fourpences, which, reduced to shillings by dividing by 3 or taking $\frac{1}{3}$ thereof for shillings, the remainder is fourpences, which may be multiplied by 12, and divided by 3, for pence, as in compound division.—The shillings are reduced to pounds by 20 as in common reduction.

A Table of the Aliquot parts of Weights and Measures.

AVOIRDUPOIS WEIGHT.

Of a Ton.

cwt.	*ton.*
10	= $\frac{1}{2}$
5	= $\frac{1}{4}$
4	= $\frac{1}{5}$
$2\frac{1}{2}$	= $\frac{1}{8}$
2	= $\frac{1}{10}$

Of a Cwt.

qr.	*lb.*	*cwt.*
2	or 56	= $\frac{1}{2}$
1	or 28	= $\frac{1}{4}$
	16	= $\frac{1}{7}$
	14	= $\frac{1}{8}$
	8	= $\frac{1}{14}$

Of $\frac{1}{2}$ Cwt. or 56 lb.

lb.	*hf.cwt.*
28	= $\frac{1}{2}$
14	= $\frac{1}{4}$
8	= $\frac{1}{7}$
7	= $\frac{1}{8}$

Of $\frac{1}{4}$ Cwt. or 28 lb.

lb.	*qr.cwt.*
14	= $\frac{1}{2}$
7	= $\frac{1}{4}$
4	= $\frac{1}{7}$
$3\frac{1}{2}$	= $\frac{1}{8}$

Of a Pound.

oz.	*lb.*
8	= $\frac{1}{2}$
4	= $\frac{1}{4}$
2	= $\frac{1}{8}$

TROY WEIGHT.

Of an Ounce.

dwt.	*gr.*	*oz.*
10	. 0	= $\frac{1}{2}$
6	. 16	= $\frac{1}{3}$
5	. 0	= $\frac{1}{4}$
4	. 0	= $\frac{1}{5}$
3	. 8	= $\frac{1}{6}$
2	. 12	= $\frac{1}{8}$
2	. 0	= $\frac{1}{10}$
1	. 16	= $\frac{1}{12}$

Of a Dwt.

gr.	*dwt.*
12	= $\frac{1}{2}$
8	= $\frac{1}{3}$
6	= $\frac{1}{4}$
4	= $\frac{1}{6}$
3	= $\frac{1}{8}$
2	= $\frac{1}{12}$

LAND MEASURE.

Of an Acre.

r.	*p.*	*ac.*
2	. 0	= $\frac{1}{2}$
1	. 0	= $\frac{1}{4}$
	32	= $\frac{1}{5}$
	20	= $\frac{1}{8}$
	16	= $\frac{1}{10}$
	8	= $\frac{1}{20}$

CLOTH MEASURE.

Of a Yard.

qr.	*nl.*	*yd.*
2	. 0	= $\frac{1}{2}$
1	. 0	= $\frac{1}{4}$
	2	= $\frac{1}{8}$
	1	= $\frac{1}{16}$

Of an English Ell.

qr.	*nl.*	*En. ell.*
2	. 2	= $\frac{1}{2}$
1	. 1	= $\frac{1}{4}$
1	. 0	= $\frac{1}{5}$
	2	= $\frac{1}{10}$
	1	= $\frac{1}{20}$

Of a Flemish Ell.

qr.	*nl.*	*Fl. el.*
1	. 2	= $\frac{1}{2}$
1	. 0	= $\frac{1}{3}$
	3	= $\frac{1}{4}$
	2	= $\frac{1}{6}$
	1	= $\frac{1}{12}$

Of a French Ell.

qr.	*nl.*	*Fr. el.*
3	. 0	= $\frac{1}{2}$
2	. 0	= $\frac{1}{3}$
1	. 2	= $\frac{1}{4}$
1	. 0	= $\frac{1}{6}$
	3	= $\frac{1}{8}$
	2	= $\frac{1}{12}$
	1	= $\frac{1}{24}$

Case II. (*b*)

If you can take several aliquot parts, and parts of parts, such

6*d.*	$\frac{1}{2}$	457 yards at 7*d.* *per yard.*
		228 . 6
1*d.*	$\frac{1}{6}$	38 . 1
	2,0	26,6. 7

Ans. £13 . 6*s.* 7*d.*

(*b*) Any number of yards at 6*d.* *per yard* will come to half as many shillings, and at 1*d.* *per yard* one-twelfth of the number of yards or one-sixth of the price at 6*d.*; the sum of these parts is the answer, as in the example.

that their sum will be the price, then the sum of the like parts of the quantity will be the answer.

(3) What will 278*cwt.* come to at 9*d.* 7*d.* 11*d.* and 10*d. per cwt.?*
(4) What will 678*lb.* come to at $3\frac{3}{4}d.$ $8\frac{3}{4}d.$ $9\frac{3}{4}d.$ and $10\frac{3}{4}d.$ *per lb.?*
(5) What will 1725*yd.* come to at $6\frac{1}{2}d.$ $7\frac{1}{2}d.$ $8\frac{1}{4}d.$ and $11\frac{1}{4}d.$ *per yd.?*

Case III. (*c*)

If the price be less than a penny, you may take parts of a penny, or of some number of pence, and reduce the answer to shillings.

(6) What will 789*yds.* come to at $\frac{1}{2}d.$ $\frac{1}{4}d.$ and $\frac{3}{4}d.$ *per yard?*
(7) What will 2795*yds.* come to at $\frac{3}{4}d.$ $\frac{1}{4}d.$ and $\frac{1}{2}d.$ *per yard?*

Case IV. (*d*)

If the price be less than a shilling, or exceed it by the aliquot part of a shilling, you may subtract such part of the quantity from the quantity, or add it to the quantity for the answer in shillings.

(8) What will 327*yds.* come to at 9*d.* 8*d.* $10\frac{1}{2}d.$ and 11*d.* *per yd.?*
(9) What will 349*lb.* come to at 1*s.* 2*d.*; 1*s.* 3*d.*; 1*s.* 4*d.*; and 1*s.* 6*d. per lb.?*
(10) What will 763*cwt.* come to at 22*d.*; $23\frac{1}{2}d.$; and 1*s.* $7\frac{3}{4}d.$ *per cwt.?*

7468 at $\frac{2}{3}d.$ *per yard.*

7468
2

3)14936

12)4978 $\frac{2}{3}d.$

2,0)41,4 . $10\frac{2}{3}d.$

£20 14*s.* $10\frac{3}{4}d.$

(*c*) Multiply by 2, and divide the product by 3; reduce this quotient to pounds and shillings, as in the example.

746 yards at $10\frac{1}{2}d.$ at 1*s.* $1\frac{1}{2}d.$ *per yard.*

$1\frac{1}{2}d.$	$\frac{1}{8}$	746
		93 . 3*d.*
	2,0	65,2 . 9*d.*

Ans. £32 . 12*s.* 9*d.*

$1\frac{1}{2}d.$	$\frac{1}{8}$	746
		93,. 3*d.*
	2,0	83,9 . 3*d.*

Ans. £41 . 19*s.* 3*d.*

(*d*) At 1*s. per yard*, the number of *yds.* is the number of shillings they will cost at $1\frac{1}{2}$ *per* $\frac{1}{8}$ thereof, which subtracted from the price at a shilling, leaves the price at $10\frac{1}{2}d.$ or added to the price at a shilling, gives the price at 1*s.* $1\frac{1}{2}d.$ as in the two annexed examples.

Case V. (*e*)

If the price be shillings and pence, you must multiply by the shillings and take parts of the quantity as before for the pence, the sum will be the answer in shillings.

(11) What will 328*yd.* come to at 3*s.* 4*d.*; 7*s.* 9*d.*; and 15*s.* 8*d.* *per yard?*

(12) What will 473*cwt.* come to at 16*s.* 10½*d.*; 5*s.* 11*d.*; and 7*s.* 5¼*d. per cwt.?*

Case VI. (*f*)

If the price be only an even number of shillings, you may multiply by half their number, and double the units' figure in the products for shillings, the rest will be pounds.

(13) What will 276*yds.* come to at 6*s. per yard?*

(14) What will 347*cwt.* cost at 4*s.*; 8*s.*; 10*s.*; 12*s.*; and 16*s.* *per cwt.?*

(15) What will 286 ells cost at 14*s.*; 18*s.*; 22*s.*; and 2*s. per ell?*

Case VII. (*g*)

If the price be an odd number of shillings, you may work as before for the greatest even number, and take $\frac{1}{20}$ of the given quantity for the odd shilling.

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247 yards at 3*s.* 4*d. per yard.*

4*d.*	⅓	247
		3
		741
		82 . 4*d.*
	2,0	82,3 . 4*d.*

Ans. £41 . 3*s.* 4*d. per yard.*

(*e*) Any number of yards at 3*s.* *per yard* will cost so many times 3*s.* or three times as many shillings as there are yards, and 4*d.* is ⅓ of a shilling, the sum of these is the price at 3*s.* 4*d.* as in the annexed example.

247 yards at 6*s. per yard.*

247
3
Ans. £74 . 2*s.*

(*f*) To multiply by 6 and divide by 20 is the same as to multiply by 3, (that is the half of 6) and divide by 10, and to divide by 10 is only cutting off the units' figure, which figure so cut off, multiplied by 20, and divided by 10, is only double for shillings.

247 yards at 7*s. per yard.*

½,0	24,7
	3
	74 . 2*s.*
	12 . 7*s.*

Ans. £86 . 9*s.*

(*g*) Find the price as before at 6*s.* then $\frac{1}{20}$ of the number of yards at 1*s.* *per yard* will be pounds, which added to the former, gives the answer, as in the example.

(16) What will 195*yd.* come to at 7*s. per yard?*
(17) 347*yd.* at 9*s.*; 11*s.*; 17*s.*; 23*s.*; and 37*s. per yard?*
(18) 1946*cwt.* at 3*s.*; 15*s.*; 21*s.*; 13*s.*; and 19*s. per cwt.?*

Case VIII. (*h*)

If the price be an odd number of shillings and some pence, work as before for the shillings, and take parts of the odd shillings for the pence.

(19) What will 273*yds.* come to at 5*s.* 6*d. per yard?*
(20) 347*yds.* at 7*s.* 9*d.*; 13*s.* 10½*d.*; 17*s.* 11*d.*; and 23*s.* 5¾*d. per yd.?*
(21) 189*cwt.* at 15*s.* 10*d.*; 17*s.* 7¾*d.*; 19*s.* 10¾*d.*; and 3*s.* 8¾*d. per cwt.?*

Case IX. (*i*)

If the price be the aliquot part of a pound, the like part of the quantity is the answer in the pounds.

(22) What will 476*yds.* come to at 10*s. per yard?*
(23) 327*yd.* at 6*s.* 8*d.*; 5*s.*; 4*s.*; 3*s.* 4*d.*; 2*s.* 6*d.*; and 2*s. per yard?*
(24) 639*yd.* at 8*s.* 4*d.*; 0*s.* 8*d.*; 1*s.* 8*d.*; 0*s.* 6*d.*; 2*s.* 6*d.*; and 4*s.* 3*d. per yard?*

Case X. (*k*)

If you can take several such parts, or parts of parts of a

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246 yards at 7*s.* 9*d. per yard.*

1*s.*	12,0	24,6
		3
		73 . 16*s.*
6*d.*	½	12 . 6
3*d.*	½	6 . 3
		3 . 1 . 6*d.*

Ans. £95 . 6*s* . 6*d.*

(*h*) The value at 7*s.* is found as before, and at 6*d.* it is half as much as at 1*s.*, and at 3*d.* half as much as at 6*d.* the sum of which is the answer.

247 yards at 3*s.* 4*d. per yard.*

3*s.* 4*d.*	⅙	247
		£41. 3*s.* 4*d.*

(*i*) At 1*l.* per yard, any number of yards will cost as many pounds as there are yards, and because 3*s.* 4*d.* is ⅙ of a pound, they will cost at 3*s.* 4*d.* per yard, ⅙ part of what they will cost at 1*l. per yard.*

247*yds.* at 12*s.* 6*d.*

10*s.*	½	247
		123 . 10*s.*
2*s.*6*d.*	¼	30 . 17.6*d.*

Ans. £154 . 7*s.* 6*d.*

(*k*) At 10*s.* they will cost half as much as at 1*l.*, at 2*s.* 6*d.* 1-*fourth* of what they will cost at 10*s.* or 1-*eighth* of what they will cost at a pound, the sum is what they cost at 12*s.* 6*d.*—The remainder must always be reduced as in compound division.

pound, that their sum will be the price, then the sum of the like parts of the quantity will be the answer in pounds.

(25) What will 327*yd.* come to at 15*s. per yard?*
(26) 196*yd.* at 17*s.* 6*d.*; 18*s.* 6*d.*; 13*s.* 4*d.*; 17*s.* 9*d.*; 12*s.* 10*d.*; and 18*s.* 11*d. per yard?*
(27) 375*yd.* at 18*s.* 4*d.*; 17*s.* 10*d.*; 11*s.* 10*d.*; 16*s.* 3*d.*; and 15*s.* 9*d. per yard?*

Case XI. (*l*)

If the price be pounds, shillings, and pence, you may multiply by the pounds, and take parts as before for the shillings and pence.

(28) What will 326*cwt.* come to at 2*l.* 16*s.* 8*d. per cwt.?*
(29) 349*cwt.* at 1*l.* 14*s.* 8*d.*; 3*l.* 14*s.* 9*d.*; and 5*l.* 7*s.* 8*d. per cwt.?*
(30) 178*cwt.* at 14*l.* 3*s.* 9*d.*; 7*l.* 17*s.* 7*d.*; and 12*l.* 19*s.* 10*d. per cwt.?*

Case XII.

If the given quantity have a fraction, or some less part of weight, measures, &c., annexed; work for the whole number by the preceding rules; and take parts of the given price for the fraction.

(31) What will $27\frac{1}{2}$*cwt.* come to at 2*l.* 14*s.* 6*d. per cwt.?*
(32) $326\frac{3}{4}$*yd.* at 17*s.* 9*d. per yard?*
(33) $104\frac{1}{4}$*yd.* at 2*l.* 15*s.* 10*d. per yard?*
(34) 328*cwt.* 3*qr.* 14*lb.* at 7*l.* 13*s.* 7*d. per cwt.?*
(35) $184\frac{5}{8}$*yd.* at 37*s.* 10*d. per yard?*
(36) 87*cwt.* 1*qr.* 17*lb.* at 7*l.* 3*s.* $10\frac{1}{2}$*d. per cwt?*
(37) 43*lb.* 14*oz.* of tea at 7*s.* 8*d. per lb.?*
(38) 125*yd.* 3*qr.* 2*nl.* at 23*s.* 6*d. per yard?*
(39) $47\frac{2}{3}$*yd.* $84\frac{5}{8}$*yd.* and $127\frac{5}{6}$*yd.* at 1*l.* 13*s.* 9*d. per yard?*
(40) 17*cwt.* 1*qr.* 17*lb.* at 1*l.* 4*s.* 9*d. per cwt.?*
(41) 85*cwt.* 1*qr.* $10\frac{1}{2}$*lb.* at 1*l.* 7*s.* 8*d. per cwt.?*
(42) 37*cwt.* 2*qr.* 13*lb.* at 4*l.* 14*s.* 6*d. per cwt.?*
(43) 18*cwt.* 1*qr.* 11*lb.* at 6*l.* 19*s.* 11*d. per cwt.?*
(44) 19*cwt.* 3*qr.* 19*lb.* at 2*l.* 4*s.* 8*d. per cwt.?*
(45) 17*lb.* 5*oz.* 14*dwts.* at 3*l.* 6*s.* 9*d. per lb.?*

247*yds.* at 2*l.* 15*s. per yard.*

10*s.*	$\frac{1}{2}$	247	(*l*) The quantity multiplied by 2 gives the value at 2*l.*, for 10*s.* take half the quantity, and for 5*s.* half the value at 10*s.* or $\frac{1}{4}$ of the quantity, the sum is the answer, as in the work.
		2	
		494	
5*s.*	$\frac{1}{2}$	123 . 10*s.*	
		61 . 15*s.*	

Ans. £679 . 5*s.*

(46) 725*a.* 2*r.* 19*p.* at 2*l.* 11*s.* 9*d. per acre?*
(47) 4*yd.* 2*qr.* 3*nl.* at 1*l.* 2*s.* 4*d. per yard?*
(48) 3*gal.* 5*qt.* at 7*s.* 6*d. per gal.?*
(49) 121*oz.* 17*dwt.* 16*gr.* at 3*l.* 15*s. per oz.?*
(50) 544*yd.* 2*ft.* 10*in.* at 5*s.* 6*d. per yard?*
(51) 4*oz.* 15*dwts.* 5*grs.* at 4*l. per oz.?*
(52) 27*a.* 1*r.* 5*p.* at 1*l.* 7*s.* 7*d. per acre?*
(53) 64*bush.* 1*pk.* 6*qt.* at 8*s.* 9*d. per bushel?*
(54) 86*a.* 2*r.* 30*p.* at 2*l.* 10*s.* 6*d. per acre?*
(55) 116*qrs.* 5*bush.* 3*pk.* at 2*l.* 11*s.* 8*d. per qr.?*
(56) 6953*qrs.* 4*bush.* 1*pk.* 2*qt.* 1*pt.* at 2*l.* 15*s.* 9¼*d. per qr.?*

QUESTIONS.

TO EXERCISE THE RULES IN PRACTICE.

(1) What will 27¼*yd.* come to at 17*s.* 11½*d. per yard?*
(2) What will 34*cwt.* cost at 2*l.* 17*s.* 4½*d. per cwt.?*
(3) What will 374*yd.* come to at 18*s.* 5¾*d. per yard?*
(4) What will 111*cwt.* come to at 6*s.* 8*d. per cwt.?*
(5) What will 137*yd.* come to at 17*s. per yard?*
(6) What will 411*cwt.* come to at 24*s. per cwt.?*
(7) 336*lb.* at 8*s.*; 1*s.* 4*d.*; 9*s.*; and 1*s.* 3*d. per lb.?*
(8) 7496*yd.* at ⅜*ths* of a penny *per yard?*
(9) 134 at 7½*d.*; 10½*d.*; and 11½*d.?*
(10) 648*cwt.* at 4*d.*; 3*d.*; 1*s.* 7*d.*; 2*s.* 9*d.*; and 3*l.* 14*s.* 6*d. per cwt.?*
(11) 176*lb.* at 2*d.*; 2*s.* 2*d.*; 2*l.* 2*s.* 2*d.*; and 2*l.* 13*s.* 8*d. per lb.?*
(12) 346¾*yd.* at 4*d.*; 9*d.*; 16*d.*; 7*s.* 9*d.*; and 7*l.* 17*s.* 9*d. per yard?*
(13) 1612*cwt.* 1*qr.* 20*lb.* at 2*s.* 6*d.*; 13*s.* 9*d.*; and 3*l.* 4*s.* 3½*d. per cwt.?*
(14) 17⅞*yd.* at 5*s.* 3*d.*; 17*s.* 4*d.*; 9*s.*; and 1*l.* 17*s.* 6*d. per yard?*
(15) 24*yd.* at 3*s.* 4*d.*; 7*s.* 10½*d.*; and 1*l.* 14*s.* 11*d. per yard?*
(16) 17*lb.* at 3¼*d.*; 19*s.* 6*d.*; and 27*l.* 14*s.* 9*d.?*
(17) 17½*lb.* at 6*d.*; 2*s.* 4½*d.*; and 3*l.* 11*s.* 10½*d.?*
(18) 1004*yd.* at 1*d.*; ½*d.*; ⅜*d.*; ⅛*d.*; ⅕*d.*; and ⅗*d. per yard?*
(19) 2076*cwt.* at 2*l.* 17*s.* 11*d.*; 14*s.* 10*d.*; 28*s.* 6*d.*; and 5¾*d. per cwt.?*
(20) 378*cwt.* at 47*s.* 11¼*d.*; 14*l.* 6*s.* 7½*d.*; 3*s.* 8½*d.*; and 11¾*d. per cwt.?*
(21) What will 9*cwt.* 1*qr.* 24*lb.* cost at 7¾*d.*; 17*s.* 7¾*d.*; 1*s.* 10¾*d.* 32*s.* 1½*d.*; and at 3*l.* 10*s.* 10½*d. per cwt.?*
(22) What will 7*lb.* 14*oz.* come to at 4*s.* 2*d.*; 7*s.* 4*d.*; 15*s.* 8*d.*; 1*l.* 12*s.* 2½*d.*; and 4*l.* 3*s.* 11*d. per lb.?*
(23) What will 147 sheep come to at 6*s.* 8*d.*; 9*s.* 2*d.*; 11*s.* 5*d.*; 13*s.* 4*d.*; 17*s.* 2*d.*; and 21*s.* 7½*d. per sheep?*
(24) What will 2143 ells come to at 2*s.* 7½*d.*; 13*s.* 4¾*d.*; 23*s.* 5¾*d.*; and 1*l.* 17*s.* 8¾*d. per ell?*

(25) What will 3414*yd.* come to at $\frac{1}{4}d.$; $\frac{3}{4}d.$; 7*s.* $5\frac{1}{4}d.$; 2*l.* 11*s.* $10\frac{3}{4}d.$; and at 3*l.* 0*s.* $8\frac{1}{4}d.$ *per yard?*

(26) Value 5467*yds.* at 5*s.* $7\frac{1}{4}d.$; and 3092 at 11*s.* $10\frac{3}{4}d.$ *per yard.*

(27) Required the value of $796\frac{1}{2}$*cwt.* at 105*s.* 6*d*; $379\frac{1}{4}$*cwt.* at 111*s.* 9*d.*; and 576*cwt.* at 114*s.* 11*d.* *per cwt.*

(28) What will be the value of 415*yds.* 3*qr.* at 17*s.* 10*d.*; 763*yds.* 2*qr.* 1*nl.* at 2*s.* $9\frac{1}{2}d.$; and 317*yds.* 3*qr.* 2*nl.* at 23*s.* 5*d.* *per yard?*

(29) Value 379*cwt.* 3*qr.* 18*lb.* at 15*s.* 8*d.*; 594*cwt.* 2*qr.* 14*lb.* at 19*s.* 11*d.*; and 1091*cwt.* 1*qr.* 20*lb.* at 31*s.* 9*d.* *per cwt.*

(30) Find the value of 113*a.* 3*r.* 8*p.* at 3*l.* 17*s.* 6*d*; 79*a.* 2*r.* 5*p.* at 3*l.* 19*s.* 8*d.*; and 104*a.* 3*r.* 25*p.* at 5*l.* 11*s.* 9*d.* *per acre.*

(31) Required the value of $117\frac{5}{8}$*yd.* at 6*s.* 9*d.*; $101\frac{3}{8}$*yd.* at 17*s.* 10*d.*; $914\frac{7}{8}$*yd.* at 22*s.* 7*d.* *per yard.*

PROMISCUOUS QUESTIONS

FOR EXERCISE IN ALL THE FOREGOING RULES.

(1) What is the sum, difference, product, and quotient, of 468 and 5618, also of 19812 and 762?

(2) What is the difference between 46 times 62*l.* 5*s.* 5*d.* and a 46*th* part of it?

(3) If 15 men can raise 60 yards of a wall in 8 days, how many yards would 96 men raise in the same time?

(4) What will $437\frac{3}{4}$*yds.* of cloth come to at 17*s.* 9*d.* *per yard*; also 56*cwt.* 1*qr.* 19*lb.* of sugar at 79*s.* 9*d.* *per cwt.?*

(5) If 346*yd.* of cloth cost 195*l.* 17*s.* 6*d.* what is it *per yard?*

(6) How much will $30\frac{1}{4}$*yd.* of cloth cost at $11\frac{3}{4}d.$ *per yard*; and 762*lb.* of currants at $8\frac{1}{4}d.$ *per lb.?*

(7) If 24 men can raise 60 yards of a wall in 7 days, in what time would 96 men raise the same number of yards?

(8) A man has 150*l.* 15*s.* 9*d.* how much will he have left after paying to 6 persons each 15*l.* 13*s.* $6\frac{1}{2}d.$?

(9) What is the difference between 15 reams of paper at 30*s.* 3*d.* *per ream*, and 23 reams at 17*s.* 9*d.* *per ream?*

(10) Six dozen of buttons cost 14*s.* 6*d.* what are they *per doz.?*

(11) How many men will be able to do as much work in 17 days as 7 men can do in 119 days?

(12) From the 11*th* part of 109*l.* 6*s.* 3*d.* take the 17*th* part of 91*l.* 19*s.* $0\frac{3}{4}d.$

(13) If $23\frac{1}{4}$*cwt.* be carried $28\frac{1}{2}$ miles for 1*l.* 9*s.* 6*d.* what must be paid for carrying $91\frac{1}{2}$*cwt.* $47\frac{3}{4}$ miles?

(14) Find the value of $69\frac{1}{2}$ yards at 2*s.* $3\frac{1}{2}d.$; $67\frac{1}{4}$ yards at 2*s.* $4\frac{3}{4}d.$; $97\frac{3}{4}$ yards at 2*s.* $5\frac{1}{2}d.$; and 79 yards at 2*s.* $7\frac{1}{4}d.$ *per yard.*

(15) What quantity of currants at $7\frac{3}{4}d.$ *per lb.* must be given for 2*cwt.* 3*qr.* 19*lb.* of sugar at $10\frac{1}{4}d.$ *per lb.?*

(16) What length of stuff 3*qr.* wide, will line a piece of cloth which is 14*yd.* long and $1\frac{3}{4}$ wide?

(17) Whether is 42 times $6\frac{3}{4}d.$ or 8 times 4*s.* $6\frac{1}{4}d.$ more?

(18) Required the value of 15*cwt.* 2*qr.* 16*lb.* of madder at 95*s.* 6*d.*; 15*cwt.* 1*qr.* 20*lb.* at 97*s.* 8*d*; 18*cwt.* 3*qr.* 19*lb.* at 101*s.* 3*d. per cwt.*

(19) If 9 bushels of corn serve 8 horses 12 days, in how many days will 16 horses eat 24 bushels?

(20) If 50 acres of grass be mowed by 9 men in 5 days, how many men will do the same quantity in 15 days?

(21) Value 109*yd.* of cloth at 5*s.* $3\frac{1}{4}d.$; 3 pieces, each 31*yd.* at $22\frac{1}{2}d.$; and 4 pieces, each $32\frac{1}{2}yd.$ at $23\frac{3}{4}d.$ *per yard.*

(22) Required the weight of a *hhd.* of sugar, which at 72*s.* 9*d. per cwt.* cost 28*l.* 7*s.*

(23) Required the value of 6 bags of hops, No. I.—1*cwt.* 2*qr.* 19*lb*; No. II.—$1\frac{3}{4}$*cwt*; No. III.—1*cwt.* 1*qr.* 17*lb*; No. IV.—$1\frac{1}{4}$*cwt*; No. V.—1*cwt.* 3*qr.* 5*lb*; No. VI.—$1\frac{1}{2}$*cwt.* at $8\frac{1}{4}d.$ *per lb*; duty 2*d. per lb.*

(24) How far may 84*cwt.* 1*qr.* 26*lb.* be carried for 8*gs.* when 35*cwt.* 1*qr.* 9*lb.* is carried 72*m.* 5*fur.* for the same money?

(25) Bought 16*cwt.* 3*qr.* 16*lb.* of rice at 31*s.* 6*d. per cwt.*, and 9*cwt.* 2*qr.* 5*lb.* of Scotch barley at 35*s.* 6*d. per cwt.*, what did I gain by selling each quantity at $4\frac{1}{2}d.$ *per lb.*?

(26) Gave 180*l.* for 729 yards of cloth, how must I sell it *per yard*, to lose no more than 22*l.* 10*s.* by it?

(27) Find the cost of 17*hhd.* of tobacco, each 6*cwt.* 3*qr.* 19*lb.* at $2\frac{5}{8}d.$ *per lb.*

(28) I bought 13*cwt.* 3*qr.* 17*lb.* of gum at 4*s.* 9*d. per lb.* how must I sell it a pound to gain 30*gs.* by it?

(29) How far may 94*cwt.* 2*qr.* 26*lb.* be carried for 8*gs.* when 35*cwt.* 1*qr.* 19*lb.* are carried 70*m.* 6*fur.* for 5*l.* 10*s.* 6*d.*?

(30) What will be the cost of 4 bales of New Orleans cotton, averaging each 3*cwt.* 1*qr.* 19*lb.* at $6\frac{1}{4}d.$ *per lb.*?

(31) A grocer bought 16*cwt.* 3*qr.* 11*lb.* of sugar, which he sold at 78*s.* 3*d. per cwt.* and gained 17*l.* 10*s.* by it, what did it cost *per cwt.*?

(32) A merchant failing, owes 1756*l.* 16*s.* and has property to the amount of 566*l.* 9*s.* 6*d.* how much does he pay *per pound*?

(33) If 8 men do 32 roods of ditching in 6 days, how many men will do 192 roods in 21 days?

(34) Bought 16*cwt.* 1*qr.* 22*lb.* of madder, at $5\frac{1}{2}$*gs. per cwt.* how must I sell it *per cwt.* to gain 25*gs.* by it?

(35) Find the value of 7 bags of Bowed cotton, each 2*cwt.* 3*qr.* 15*lb.* at $5\frac{1}{8}d.$ *per lb.*

(36) Required the value of 6 pieces of Irish linen, each $26\frac{1}{2}$*yds.* at 2*s.* $2\frac{1}{2}d.$ *per yard*, and 7 pieces of calico, each $29\frac{1}{4}$ *yards*, at $14\frac{1}{4}d.$ *per yard.*

(37) If 188 men do 192 roods of draining in 21 days, how many men will do 32 roods in 6 days?

(38) The rent of my house is 65*gs.* but I have paid the poor-rate, 3*s.* 6*d.* in the pound, how much has my landlord to receive?

(39) Required the value and average price per yard of 4 pieces, each $28\frac{1}{4}yd.$ at 2*s.* 2*d.*; 6 pieces, each $33\frac{1}{2}yd.$ at 2*s.* 5*d.*; and 8 pieces, each $31\frac{3}{4}yd.$ at 2*s.* 7*d. per yard.*

(40) A man, whose yearly income is 396*l.* 10*s.* 6*d.* spends 14*s.* 4*d. per day*, how much does he lay up in a year?

(41) Bought 13 bags of South Sea Island cotton, each 2*cwt.* 1*qr.* 21*lb.* at $6\frac{3}{4}d.$ *per lb.* and sold them again at $7\frac{3}{8}d.$ *per lb.* what was my gain?

(42) What will be the amount of 17 bags of Egyptian cotton, each 1*cwt.* 3*qr.* 23*lb.* at $6\frac{1}{8}d.$ *per lb.?*

(43) A man whose yearly income is 210*l.* 9*s.* 7*d.* lays up 33*gs.* a year, how much may he spend a day?

(44) If 3 men earn 55*s.* 6*d.* in 6 days, how much will 12 men earn in a year?

(45) If 16 pieces of muslin cost 56*l.* at 2*s.* 6*d. per yard*, how many yards are there in a piece?

(46) What will 26*cwt.* 3*qr.* 7*lb.* of cheese come to at 43*s.* 9*d. per cwt.* and what is it *per lb.?*

(47) If 30 men be required to do a piece of work in 12 days, how many will it employ 18 days?

(48) John borrowed 250*l.* of James for 7 months, how long ought John to lend James 300*l.* to return the favour?

(49) Required the value of 19 bales of Pernambucca cotton, each 1*cwt.* 2*qr.* 27*lb.* at $7\frac{3}{8}d.$ *per lb.*

(50) If $12\frac{1}{2}$*cwt.* be carried 30*m.* 3*fur.* 25*p.* for 36*s.* 6*d.* what weight will be carried 186*m.* for the same money?

(51) How much will 32 men earn in 24 days, when 40*s.* are earned by 8 men in 5 days?

(52) Required the value of $\frac{3}{8}$, $\frac{5}{8}$, and $\frac{7}{8}$, of a yard of cloth, at 17*s.* $11\frac{3}{4}d.$ *per yard.*

(53) Bought 7 pieces of cambric, each $12\frac{1}{2}yd.$ at 11*s.* 9*d. per ell* Flemish, what do they come to?

(54) Required the value of 6*cwt.* 3*qr.* 17*lb.* of sugar at 76*s.* 3*d. per cwt.*; and of 7 casks, each 2*cwt.* 1*qr.* 19*lb.* at $8\frac{3}{4}d.$ *per lb.*

(55) Suppose my horse eats a stone and a quarter of hay a day, how much will he eat in 4 months, and what will it cost at $10\frac{1}{4}d.$ per stone of 16*lb.?*

(56) Bought $6\frac{1}{2}$ puncheons of rum at 75*l.* 6*s.* per puncheon, which I sold at 15*s.* 6*d. per gallon*, what did I gain?

(57) What will 12 ells English, 10 ells Flemish, and 10 ells French, come to at 4*s.* 4*d. per yard?*

(58) Find the difference in value between 9 bags of Maranham cotton, each 1*cwt.* 2*qr.* 13*lb.* at $6\frac{3}{4}d.$; and $7\frac{1}{4}d.$ *per lb.*

(59) Bought 46*cwt.* 3*qr.* 14*lb.* of sugar for 3*l.* 5*s.* *per cwt.* and sold it again for $7\frac{1}{2}d.$ *per lb.*; what did I gain?

(60) A person bought 233 pieces of cloth, each $29\frac{1}{2}yd.$ at $22\frac{1}{2}d.$ *per yard*, and sold them again at 2*s.* $3\frac{1}{2}d.$ *per yard*; what did he gain?

(61) How many men will dig a trench 168*yd.* long in 16 days, when 48 men dig 14*yd.* long in 12 days?

(62) If 14 men build a wall 16 roods long in 15 days, how many would do it in two days?

(63) Bought 4*hhds.* of sugar, each 7*cwt.* 1*qr.* 25*lb.* at 64*s.* 7*d.* *per cwt.* and sold it again at $8\frac{3}{4}d.$ *per lb.*; what did I gain?

(64) A person bought 34*yd.* of cloth at 7*s.* $4\frac{1}{2}d.$ *per yard*; $17\frac{3}{4}$ yards at 8*s.* 2*d.* *per yard*, and $56\frac{1}{4}yd.$ at 7*s.* $11\frac{1}{4}d.$ *per yard*, required the value and average price per yard.

(65) A hogshead of wine containing 63*gal.* cost 15*l.* carriage, and porterage 15*s.*; how must it be sold per gallon and *per bottle* to gain 6*gs.* by it?

(66) A manufacturer gave 24*l.* for a quantity of wool, the spinning, weaving, dyeing, and dressing of which cost 20*l.* he sold the cloth at 5*s.* 3*d.* *per yard*, and gained 15*l.* by the whole; how many yards had he?

(67) When wine is worth 30*l.* a hhd. 20*l.* worth serves 100 men, how many men will 4*l.* worth be sufficient for, when it sells at 24*l.* *a hhd.*?

(68) Bought 57 fothers of lead at 23*s.* 8*d.* *per cwt.*, paid carriage 9*s.* 9*d.*; how must I sell it *per lb.* to lose no more than 3*l.* 3*s.* 7*d.* by it?

(69) A man bought 50 eggs at 5 for 3*d.* and 50 more at 8 for 1*s.*; what did he gain by selling them at $2\frac{3}{4}d.$ a piece?

(70) Bought 3 pipes of wine at $73\frac{1}{2}gs.$ *per pipe*; but on bottling it I found it had leaked 17*gal.*; what does it cost me per dozen bottles?

Note.—A bottle may be supposed to contain a quart.

(71) What will be the value of 11 bags of Maccios cotton, each 1*cwt.* 1*qr.* 22*lb.* at $6\frac{3}{8}d.$ and $7\frac{7}{8}d.$ *per lb.*?

(72) If 4*hhd.* of treacle cost 50*gs.* at 37*s.* 8*d.* *per cwt.* what quantity is there in each?

(73) Required the value, at 7*s.* 4*d.* *per ell Eng.* of 21 pieces of cloth, each $27\frac{1}{4}yd.$ long.

(74) Required the value of 17 bags of New Orleans cotton, each 3*cwt.* 1*qr.* 26*lb.* at 6*d.* *per lb.*; and 2*l.* 16*s.* *per cwt.*

(75) At 9*s.* $6\frac{3}{4}d.$ *per ell Flem.* how many yards of cloth may I have for 201*l.* 15*s.* $4\frac{1}{2}d.$?

(76) How many ells Eng. of cloth may I have for 25*l.* 18*s.* $1\frac{3}{4}d.$ at 7*s.* $9\frac{1}{2}d.$ *per yard?*

(77) Bought 216 ells French of velvet for 400*l.*; carriage &c. cost 7*s.* 6*d.*; what does a yard cost me?

(78) Bought 72 pieces of cloth for 537*l.* 12*s.* at 5*s.* 4*d.* *per ell* Flemish, how many yards do they contain, and how many ells English in a piece?

(79) Required the value of 743 yards at 3*s.* 4*d.*; 757*yd.* at $3\frac{3}{4}d.$; 931*yd.* at 16*s.* 8*d*; and 537*yd.* at 8*s.* 4*d.* *per yard.*

(80) Required the value of 957*lb.* at 15*d*; 1713*lb.* at $7\frac{1}{2}d$; 737*lb.* at 18*s.* 4*d*; and 137*lb.* at 11*s.* 8*d.* *per lb.*

(81) Required the value of 157*cwt.* at 7*s.* 4*d*; 795*cwt.* at 22*d*; 783*cwt.* at $5\frac{1}{4}d$; and 1511*cwt.* at 19*s.* 10*d.* *per cwt.*

(82) Required the value of 175*yd.* at $23\frac{3}{4}d$; 873*yd.* at 2*s.* 10*d*; 891*yd.* at 3*s.* 7*d*; and 703*yd.* at 6*s.* 11*d.* *per yard.*

(83) Required the value of 9 pieces of cloth, each 26*yd.* at $18\frac{1}{2}d$; 13 pieces each $26\frac{1}{2}yd.$ at 19*d*; and 11 pieces, each 27*yd.* at $20\frac{1}{2}d.$ *per yard.*

(84) What will be the value of 3 pieces, each $47\frac{1}{4}yd.$ at 5*s.* $1\frac{3}{4}d$; 6 pieces, each $46\frac{1}{2}yd.$ at 5*s.* 3*d*; and 18 pieces, each $48\frac{1}{4}yd.$ at 5*s.* $3\frac{1}{2}d.$ *per yard?*

(85) Find the value of $96\frac{3}{4}lb.$ at 11*s.* 2*d*; $162\frac{1}{4}lb.$ at 12*s.* $4\frac{1}{2}d$; $13\frac{1}{2}lb.$ at 16*s.* 2*d*; and $5\frac{3}{4}lb.$ at 18*s.* 11*d.* *per lb.*

(86) Find the value of 400*cwt.* 1*qr.* 15*lb.* of cotton, at $13\frac{1}{2}d.$ *per lb*; 2*cwt.* 3*qr.* 18*lb.* at $12\frac{1}{4}d$; and 2*cwt.* 1*qr.* 23*lb.* at $23\frac{3}{4}d.$ *per lb.*

(87) Value 5 pieces, each $56\frac{1}{2}yd.$ at $23\frac{1}{4}d.$ *per yard*; 7 pieces, each $56\frac{1}{4}yd.$ at 23*d.* *per yard*; and 9 pieces, each $55\frac{3}{4}yd.$ at 22*d.* *per yard.*

(88) Required the value of 16*cwt.* 2*qr.* 21*lb.* at 37*s.* 5*d.* *per cwt*; 101*cwt.* 1*qr.* $10\frac{1}{2}lb.$ at 45*s.* 9*d.*; and 45*cwt.* 3*qr.* 25*lb.* at 5*s.* 6*d.* *per cwt.*

(89) Find the value of $45\frac{3}{16}gal.$ of rum, at 16*s.* 9*d*; $67\frac{5}{16}gal.$ at 17*s.* 10*d*; and $75\frac{3}{16}gal.$ at 18*s.* 5*d.* *per gal.*

(90) Bought 5 puncheons of rum at 15*s.* 2*d*; 3 puncheons at 14*s.* 9*d*; 7 puncheons at 16*s.* 8*d.* *per gal.*; what is the average price *per gal.*?

A SUPPLEMENT TO PRACTICE.

(1) 871 at $1\frac{1}{2}d$; 873 at $4\frac{1}{2}d$; 721 at $7\frac{1}{2}d.$

(2) 9073 at 10*d*; 159 at 8*d*; 1745 at 9*d.*

(3) 1757 at 2*d*; 764 at 4*d*; 131 at 6*d.*

(4) 913 at 16*d*; 9073 at 10*d*; 713 at 18*d.*

(5) 713 at 14*d*; 173 at 21*d*; 873 at 15*d.*

(6) 795 at 22*d*; 713 at 2*s.* 3*d*; 107 at 2*s.* 4*d.*

(7) 931 at 2*s.* 8*d*; 379 at 3*s.* 8*d*; 173 at 2*s.* 9*d.*

(8) 713 at 4*s.* 6*d*; 837 at 4*s.* 8*d*; 871 at 5*s.* 4*d.*

(9) 157 at 7*s.* 4*d*; 875 at 20*d*; 709 at 6*s.* 8*d.*

(10) 739 at 7*s.* 6*d*; 703 at 12*s.* 6*d*; 473 at 8*s.* 4*d.*

(11) 707 at 11*s.* 8*d*; 9571 at 13*s.* 4*d*; 139 at 16*s.* 8*d.*

(12) 7301 at 17*s.* 6*d*; 203 at 18*s.* 4*d*; 173 at 16*s.*
(13) 379 at 19*s.* 8*d*; 139 at 16*s.* 8*d*; 473 at 19*s.* 4*d.*
(14) 721 at $2\frac{1}{4}d$; 173 at $2\frac{1}{2}d$; 171 at $2\frac{3}{4}d$.
(15) 807 at $3\frac{1}{4}d$; 175 at $3\frac{1}{2}d$; 807 at $3\frac{3}{4}d$.
(16) 707 at 13*d*; 113 at $13\frac{1}{4}d$; 811 at $13\frac{1}{2}d$.
(17) 875 at $4\frac{1}{4}d$; 127 at $4\frac{1}{2}d$; 178 at $4\frac{3}{4}d$.
(18) 731 at 5*d*; 813 at $5\frac{1}{4}d$; 179 at $5\frac{3}{4}d$.
(19) 987 at $12\frac{3}{4}d$; 879 at $12\frac{1}{2}d$; 973 at $12\frac{1}{4}d$.
(20) 827 at $6\frac{1}{4}d$; 782 at $6\frac{1}{2}d$; 117 at $6\frac{3}{4}d$.
(21) 527 at $7\frac{1}{4}d$; 725 at $7\frac{1}{2}d$; 147 at $7\frac{3}{4}d$.
(22) 685 at $11\frac{3}{4}d$; 713 at $11\frac{1}{2}d$; 1731 at $11\frac{1}{4}d$.
(23) 179 at $14\frac{1}{2}d$; 827 at $14\frac{3}{4}d$; 837 at $14\frac{1}{4}d$.
(24) 271 at $15\frac{3}{4}d$; 173 at $15\frac{1}{2}d$; 837 at $15\frac{1}{4}d$.
(25) 173 at $21\frac{3}{4}d$; 971 at $23\frac{3}{4}d$; 917 at $22\frac{1}{2}d$.
(26) 999 at $17\frac{1}{2}d$; 617 at $16\frac{1}{4}d$; 979 at $19\frac{1}{4}d$; 971 at $20\frac{1}{4}d$.
(27) 971 at $22\frac{1}{4}d$; 837 at $18\frac{3}{4}d$; 179 at $16\frac{1}{2}d$.
(28) 723 at $23\frac{1}{4}d$; 173 at $22\frac{3}{4}d$; 717 at $17\frac{1}{4}d$.
(29) 179 at $19\frac{1}{2}d$; 808 at $23\frac{1}{2}d$; 107 at $21\frac{1}{4}d$.
(30) 827 at $20\frac{3}{4}d$; 917 at $19\frac{3}{4}d$; 139 at $18\frac{1}{4}d$; 837 at $16\frac{3}{4}d$.
(31) 873 at 2*s.* 1*d*; 907 at 5*s.* 7*d*; 139 at 7*s.* 3*d.*
(32) 717 at 8*s.* 5*d*; 831 at 4*s.* 11*d*; 871 at 6*s.* 7*d.*
(33) 971 at 3*s.* 1*d*; 177 at 7*s.* 10*d*; 711 at 9*s.* 5*d.*
(34) 917 at 2*s.* 5*d*; 371 at 8*s.* 9*d*; 871 at 4*s.* 5*d.*
(35) 979 at 3*s.* 9*d*; 871 at 7*s.* 11*d*; 177 at 4*s.* 1*d.*
(36) 173 at 5*s.* 11*d*; 873 at 9*s.* 1*d*; 117 at 7*s.* 7*d.*
(37) 171 at 2*s.* 7*d*; 909 at 6*s.* 5*d*; 971 at 8*s.* 7*d.*
(38) 973 at 3*s.* 3*d*; 917 at 5*s.* 9*d*; 117 at 9*s.* 3*d.*
(39) 939 at 8*s.* 10*d*; 175 at 4*s.* 9*d*; 173 at 2*s.* 11*d*; 173 at 6*s.* 9*d.*
(40) 107 at 3*s.* 5*d*; 117 at 8*s.* 1*d*; 917 at 8*s.* 11*d.*
(41) 705 at 4*s.* 7*d*; 917 at 4*s.* 10*d*; 937 at 7*s.* 1*d.*
(42) 871 at 6*s.* 1*d*; 931 at 7*s.* 5*d*; 130 at 7*s.* 9*d.*
(43) 111 at 3*s.* 11*d*; 109 at 5*s.* 1*d*; 931 at 9*s.* 6*d.*
(44) 131 at 11*s.* 2*d*; 931 at 15*s.* 10*d*; 137 at 12*s.* 5*d.*
(45) 171 at 10*s.* 1*d*; 917 at 15*s.* 2*d*; 913 at 9*s.* 9*d.*
(46) 107 at 10*s.* 7*d*; 732 at 14*s.* 1*d*; 917 at 11*s.* 5*d.*
(47) 903 at 14*s.* 9*d*; 913 at 11*s.* 9*d*; 157 at 10*s.* 11*d*; 131 at 15*s.* 7*d.*
(48) 309 at 12*s.* 10*d*; 131 at 11*s.* 7*d*; 913 at 10*s.* 10*d.*
(49) 917 at 15*s.* 9*d*; 837 at 11*s.* 11*d*; 137 at 9*s.* 7*d.*
(50) 171 at 12*s.* 9*d*; 309 at 10*s.* 5*d*; 175 at 15*s.* 5*d.*
(51) 735 at 12*s.* 11*d*; 937 at 14*s.* 11*d*; 917 at 10*s.* 9*d.*
(52) 317 at 15*s.* 3*d*; 131 at 12*s.* 7*d*; 137 at 11*s.* 3*d.*
(53) 276 at 14*s.* 5*d*; 947 at 13*s.* 11*d*; 137 at 11*s.* 6*d.*
(54) 171 at 14*s.* 10*d*; 131 at 9*s.* 11*d*; 173 at 11*s.* 10*d*; 171 at 14*s.* 7*d.*
(55) 137 at 1*s.* 11*d*; 313 at 12*s.* 1*d*; 171 at 15*s.* 6*d*; 179 at 15*s.* 1*d.*

(56) 317 at 19*s.* 5*d*; 171 at 17*s.* 1*d*; 137 at 15*s.* 11*d*; 137 at 17*s.* 9*d.*

(57) 871 at 17*s.* 11*d*; 117 at 19*s.* 3*d*; 171 at 19*s.* 9*d*; 937 at 16*s.* 5*d.*

(58) 133 at 16*s.* 1*d*; 907 at 18*s.* 7*d*; 131 at 18*s.* 5*d*; 147 at 16*s.* 10*d.*

(59) 731 at 18*s.* 11*d*; 901 at 17*s.* 3*d*; 917 at 19*s.* 1*d*; 131 at 17*s.* 4*d.*

(60) 371 at 16*s.* 7*d*; 137 at 18*s.* 10*d*; 371 at 19*s.* 2*d*; 871 at 17*s.* 11*d.*

(61) 107 at 19*s.* 7*d*; 913 at 16*s.* 11*d*; 373 at 17*s.* 10*d*; 979 at 18*s.* 9*d.*

(62) 873 at 19*s.* 10*d*; 147 at 17*s.* 7*d*; 173 at 18*s.* 1*d*; 139 at 19*s.* 6*d.*

(63) 741 at 16*s.* 9*d*; 971 at 17*s.* 2*d*; 909 at 17*s.* 5*d*; 17381 at 19*s.* 11*d.*

(64) 721 at 2*l.* 18*s*; 379 at 3*l.* 17*s*; 701 at 7*l.* 12*s.*

(65) 791 at 17*l.* 15*s*; 713 at 19*l.* 19*s*; 171 at 5*l.* 1*s.* 8*d.*

(66) 801 at 2*l.* 19*s.* 1*d*; 137 at 15*l.* 19*s.* 11*d*; 917 at 1*l.* 17*s.* 5*d.*

(67) 171 at 5*l.* 1*s.* 5*d*; 917 at 2*l.* 17*s.* 11*d*; 173 at 2*l.* 15*s.* 5*d.*

(68) 827 at 3*l.* 16*s.* 11$\frac{1}{4}$*d*; 901 at 4*l.* 8*s.* 7$\frac{3}{4}$*d*; 197 at 2*l.* 17*s.* 5$\frac{1}{4}$*d.*

(69) 197 at 5*l.* 6*s.* 10$\frac{1}{2}$*d*; 147 at 8*l.* 19*s.* 5$\frac{3}{4}$*d*; 197 at 2*l.* 19*s.* 11$\frac{3}{4}$*d.*

(70) 471 at 2*l.* 13*s.* 9$\frac{1}{4}$*d*; 917 at 3*l.* 7*s.* 8$\frac{1}{4}$*d*; 817 at 17*l.* 19*s.* 9$\frac{3}{4}$*d.*

(71) 937$\frac{1}{2}$ at 3*l.* 17*s.* 8*d*; 379$\frac{1}{4}$ at 2*l.* 18*s.* 7*d*; 139$\frac{3}{4}$ at 1*l.* 19*s.* 4*d.*

(72) 171$\frac{1}{8}$ at 1*l.* 19*s.* 8$\frac{1}{4}$*d*; 379$\frac{3}{8}$ at 2*s.* 9*d*; 785$\frac{5}{8}$ at 7*s.* 9$\frac{1}{2}$*d.*

(73) 735$\frac{7}{8}$ at 3*s.* 9*d*; 739$\frac{2}{3}$ at 8*d*; 1371$\frac{7}{9}$ at 6*d.*

(74) 917$\frac{1}{4}$ at 1*l.* 17*s.* 9$\frac{1}{4}$*d*; 173$\frac{1}{2}$ at 3*l.* 18*s.* 11*d*; 371$\frac{3}{4}$ at 4*l.* 13*s.* 7*d.*

(75) 137$\frac{1}{8}$ at 17$\frac{1}{2}$*d*; 197$\frac{5}{8}$ at 3*s.* 7*d*; 147$\frac{7}{8}$ at 4*l.*

(76) 793*yd.* 3*qr.* 3*nl.* at 9*l.* 19*s.* 10$\frac{3}{4}$*d*; 317*yd.* 3*qr.* 3*nl.* at 2*l.* 17*s.* 11*d*; 27*yd.* 1*qr.* 2*nl. at* 17$\frac{1}{2}$*d.*

(77) 87*lb.* 1*oz.* 4*dwts.* at 3*l.* 17*s.* 9*d*; 37*lb.* 1*oz.* at 4*l.* 17*s.* 8$\frac{1}{4}$*d*; 71*lb.* 1*oz.* 10*dwts.* at 3*l.* 13*s.* 2$\frac{1}{2}$*d.*

(78) 171*lb.* 2*oz.* 8*dwts.* at 5*l.* 8*s*; 413*lb.* 3*oz.* at 3*l.* 11*s.* 8*d*; 713*lb.* 4*oz.* at 8*l.* 7*s.* 9$\frac{3}{4}$*d.*

(79) 197*oz.* 1*dwt.* 16*gr.* at 5*s.* 10$\frac{1}{2}$*d*; 139*oz.* 2*dwt.* 12*gr.* at 5*s.* 7$\frac{1}{4}$*d*; 871*oz.* 3*dwt.* 8*gr.* at 4*l.*

(80) 187*cwt.* 1*qr.* 16*lb.* at 1*l.* 7*s.* 11$\frac{3}{4}$*d*; 98*cwt.* 0*qr.* 16*lb.* at 19*s.* 9$\frac{1}{4}$*d*; 907*cwt.* 0*qr.* 24*lb.* at 18*s.* 7$\frac{3}{4}$*d.*

(81) 97*cwt.* 2*qr.* 14*lb.* at 60*s*; 917*cwt.* 0*qr.* 14*lb.* at 63*s*; 827*cwt.* 3*qr.* 21*lb.* at 3*l.* 13*s.*

(82) 8*cwt.* 0*qr.* 21*lb.* at 3*l.* 13*s.* 7$\frac{1}{4}$*d*; 71*cwt.* 0*qr.* 20*lb.* at 3*l.* 11*s.* 2$\frac{1}{4}$*d*; 175*cwt.* 0*qr.* 18*lb.* at 4*l.* 17*s.* 9*d.*

(83) 13*cwt.* 2*qr.* 12*lb.* at 5*l.* 16*s.* 7*d*; 87*cwt.* 3*qr.* 8*lb.* at 5*l.* 5*s*; 89*cwt.* 2*qr.* 10*lb.* at 5*s.* 9*d.*

(84) 171*cwt.* 1*qr.* 4*lb.* at 3*l.* 1*s.* 4*d*; 1*cwt.* 1*qr.* 5*lb.* at 1*l.* 7*s.* 2¼*d*; 5*cwt.* 3*qr.* 6*lb.* at 4*l.* 17*s.* 9*d.*

(85) 17*cwt.* 3*qr.* 22*lb.* at 3*l.* 15*s.* 9¼*d*; 17*cwt.* 1*qr.* 23*lb.* at 4*l.* 17*s.* 8¼*d*; 1*cwt.* 1*qr.* 26*lb.* at 46*s.*

(86) 87*a.* 0*r.* 20*p.* at 30*s*; 17*a.* 3*r.* 35*p.* at 4*l*; 179*a.* 3*r.* 39*p.* at 26*s.* 8*d.*

(87) 743 at 3*s.* 4*d*; 1761 at 20*d*; 957 at 1*s.* 3*d.* Dis. 5 *per cent.*

(88) 1713 at 7½*d*; 757 at 3¾*d*; 1071 at ¾*q.* Dis. 4¾ *per cent.*

(89) 737 at 18*s.* 4*d*; 931 at 16*s.* 8*d*; 371 at 17*s.* 6*d.* Dis. 4½ *per cent.*

(90) 137 at 11*s.* 8*d*; 865 at 13*s.* 4*d*; 537 at 8*s.* 4*d.* Dis. 4¼ *per cent.*

(91) 157 at 7*s.* 4*d*; 737 at 5*s.* 6*d*; 379 at 3*s.* 8*d.* Dis. 4 *per cent.*

(92) 931 at 2*s.* 8*d*; 795 at 1*s.* 10*d*; 713 at 1*s.* 2*d.* Dis. 3¾ *per cent.*

(93) 785 at 17*s.* 6*d*; 1511 at 19*s.* 10*d*; 1109 at 19*s.* 9*d.* Dis. 3½ *per cent.*

(94) 536 at 13*s.* 4*d*; 737 at 19*s.* 4*d*; 1371 at 10½*d.* Dis. 3¼ *per cent.*

(95) 731 at 18*s.* 4*d*; 957 at 17*s.* 8*d*; 703 at 6*s.* 11*d.* Dis. 3 *per cent.*

(96) 959 at 5*s.* 10*d*; 873 at 3*s.* 10*d*; 379 at 3*s.* 8*d.* Dis. 2½ *per cent.*

(97) 891 at 3*s.* 7*d*; 931 at 2*s.* 8*d*; 873 at 2*s.* 10*d.* Dis. 2¼ *per cent.*

(98) 317 at 2*s.* 2*d*; 137 at 1*s.* 11*d*; 757 at 11½*d.* Dis. 2 *per cent.*

(99) 715 at 1¼*d*; 879 at 1*s.* 5¼*d*; 721 at 1*s.* 8¾*d.* Dis. 1¾ *per cent.*

(100) 173 at 19¾*d*; 375 at 20¼*d*; 307 at 21¾*d.* Dis. 1½ *per cent.*

(101) 317 at 21¼*d*; 107 at 22¼*d*; 199 at 22¾*d.* Dis. 1¼ *per cent.*

(102) 147 at 23¼*d*; 175 at 23¾*d*; 137 at 37*s.* 6¼*d.* Dis. 1 *per cent.*

(103) 857 at ½*d*; 8237 at 2*d*; 2780 at 8½*d*; 6019 at 3½*d*; 1270 at 11½*d*; 715 at 13½*d*; 831 at 7½*d*; 703 at 5½*d*; 5103 at 1½*d*; 3817 at 6½*d*; 446 at 2½*d*; 5326 at 10*d*; 464 at 12½*d*; 974 at 4*d*; 410 at 9½*d*; 1477 at 14*d.*

(104) 3003 at 21*d*; 7924 at 23½*d*; 1311 at 15½*d*; 719 at 18½*d*; 725 at 20*d*; 815 at 22½*d*; 513 at 14½*d*; 215 at 17½*d*; 923 at 21½*d*; 521 at 16½*d*; 6101 at 19½*d*; 1171 at 20½*d*; 8110 at ¾*d*; 2863 at 1¾*d*; 1160 at 2¾*d*; 4134 at 17¾*d*; 191 at 9¼*d*; 5154 at 11¾*d*; 987 at 13¾*d*; 2710 at 6¼*d.*

(105) 1081 at 3¾*d*; 321 at 14¾*d*; 1900 at 16¼*d*; 1001 at 4¼*d*; 1234 at 12¾*d*; 1714 at 9¾*d*; 435 at 17¼*d*; 490 at 22¾*d*; 146 at 20¼*d*; 210 at 3*s.* 3¾*d*; 174 at 4*s.* 10*d*; 234 at 5*s.* 10¼*d*; 419 at 23¾*d*; 418 at 2*s.* 5*d*; 177 at 21¼*d*; 1781

at 3*s.* $9\frac{3}{4}d$; 437 at $19\frac{1}{4}d$; 818 at 4*s.* 5*d*; 209 at 5*s.* $7\frac{1}{2}d$.

(106) 237 at 7*s.* $8\frac{3}{4}d$; 315 at 9*s.* 4*d*; 166 at 10*s.* $7\frac{3}{4}d$; 1308 at 13*s.* 11*d*; 301 at 15*s.* 4*d*; 321 at 16*s.* $10\frac{1}{2}d$; 185 at 14*s.* 3*d*; 401 at 7*s.* 11*d*; 701 at 6*s.* 5*d*; 902 at 10*s.* 10*d*; 344 at 12*s.* 7*d*; 256 at 17*s.* $7\frac{1}{4}d$; 797 at 19*s.* $8\frac{1}{2}d$; 430 at 18*s.* 4*d*; 512 at 17*s.*

(107) 617 at 19*l.* 1*s.* 9*d*; 1113 at 31*s.* 3*d*; 6431 at 43*s.* $1\frac{1}{2}d$; 5714 at 56*s.* 6*d*; 979 at 24*s*; 465 at 80*s.* 4*d*; 372 at 9*l.* 11*s.* 6*d*; 185 at 17*l.* 16*s*; 1431 at 38*s*; $371\frac{1}{2}$ at 2*s.* 7*d*; $1197\frac{1}{4}$ at 49*s.* 2*d*; $1617\frac{3}{4}$ at 6*l.* 6*s.* 6*d*; $394\frac{5}{8}$ at 14*s*; $9495\frac{7}{8}$ at 17*s.* $9\frac{1}{2}d$; $264\frac{5}{9}$ at 74*s.* 10*d.*

(108) $159\frac{2}{5}$ at 4*l.* 7*s*; 5*cwt.* 2*qr.* 16*lb.* at 56*s.* 6*d*; 7*cwt.* 1*qr.* 7*lb.* at 37*s.* 4*d*; 2*cwt.* 2*qr.* 18*lb.* at 4*l.* 11*s.* $3\frac{1}{2}d$; 9*cwt.* 1*qr.* 12*lb.* at 4*l.* 5*s.* 9*d*; 3*qr.* 11*lb.* at 14*s.* 7*d. per cwt*; 13*cwt.* 1*qr.* 26*lb.* at $15\frac{1}{4}d$; 9*lb.* 6*oz. avoir.* at 22*d. per lb.* and 11*cwt.* 1*qr.* $25\frac{3}{4}$*lb.* at 12*s.* 9*d. per cwt.*

(109) 5*yd.* 2*qr.* 1*nl.* at 5*s.* 4*d. per yard*; 21*yd.* 1*qr.* 3*nl.* at 2*s.* 2*d. per yd*; 3*qr.* 2*nl.* at 15*s.* 10*d. per yd*; 27*a.* 1*r.* 5*p.* at 27*s.* 7*d. per acre*; 13*a.* 3*r.* 24*p.* at 37*s.* $3\frac{1}{2}d$. *per acre.*

(110) 37*cwt.* 16*lb.* at 3*l.* 17*s.* 9*d*; 713*cwt.* 1*qr.* 16*lb.* at 4*l.* 17*s.* 11*d*; 123*cwt.* 24*lb.* at 7*l.* 18*s.* $3\frac{1}{4}d$; 37*cwt.* 2*qr.* 14*lb.* at 7*l.* 10*s.* $9\frac{1}{2}d$; 79*cwt.* 14*lb.* at 2*l.* 13*s.* $9\frac{1}{4}d$; 79*cwt.* 21*lb.* at 1*l.* 5*s.* 10*d*; 37*cwt.* 3*qr.* 21*lb.* at 1*l.* 17*s.* 4*d. per cwt.*

TARE AND TRETT.

This rule teaches to calculate and deduct the allowances which are made in the weight of goods.

Gross weight is the weight of the whole package before any allowance or deduction is made.

Tare is an allowance for what the goods are weighed in, as *hhd., chest, bag, box, &c.* Sometimes the tare is given in the whole, then it needs only subtracting from the gross. Sometimes it is given at so much *per cask* and *package;* then the tare of one package multiplied by the number of packages gives the whole tare to be subtracted. Sometimes it is at so much *per cwt.*, then it may be calculated by the rule of three, or by the rules in practice, taking such parts of the whole gross weight for tare as your given tare is of a hundred weight, &c.

When the *tare* is subtracted, the remainder is called *tare suttle*, if any more allowances are to be made.

Trett is an allowance of 4*lb.* at every 104, or $\frac{1}{26}$ part of the tare suttle, to be subtracted from it on some goods on account of waste, &c.—When trett is subtracted, the remainder is called *trett suttle*, if any more allowance is to be made.

Cloff is an allowance of 2*lb.* for 3*cwt.* gross in some goods on

account of dust, &c. Multiply the gross by 2, and divide the product by 3, call the hundred weights in the quotient pounds, every quarter 4*oz.* and every pound 1-*seventh* of an ounce, or every 7*lb.* 1*oz.*—Subtract the cloff from the *trett suttle*, and the remainder will be *neat weight*.

In Liverpool the tare upon cotton is always 4*lb. per* 112*lb.*; and in Manchester it is $2\frac{1}{2}$*lb. per* 100*lb.*, on all cottons except on East India. And in both towns there is a deduction of 1*lb.* on each bale upon the whole gross to be made, for the draft of the scales in weighing. This, and sometimes an allowance of 8*lb.* for ropes, on each bale of East India cotton at Liverpool must be deducted before the tare is taken.

Neat weight is what remains when all deductions are made, and is the weight charged for.

EXAMPLES.

(1) What is the neat weight of 56 barrels of anchovies, weighing in all 884*lb.* gross, allowing 8*lb. per cwt.* tare?

(2) In 46*cwt.* 3*qr.* 14*lb.* of sugar gross, tare 14*lb. per cwt.* what is the neat weight?

(3) What is the neat weight of 20 barrels of figs, each 3*cwt.* 1*qr.* 5*lb.* gross, tare 14*lb. per barrel?*

(4) If the gross weight of 4 casks of sugar be as follows, *viz.* 3*cwt.* 2*qr.* 14*lb*; 5*cwt.* 1*qr.* 17*lb*; 2*cwt.* 3*qr.* 18*lb*; and

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In 46*cwt.* 3*qr.* 14*lb.* gross, tare 14*lb. per cwt.* how much neat weight?

14*lb.*	$\frac{1}{8}$	*cwt.qrs.lbs. oz.*
		46 . 3 . 14 . 0
		5 . 3 . 12 . 4 *tare*
$\frac{1}{26}$ *cwt.*		41 . 0 . 1 . 12 *suttle*
		1 . 2 . 8 . 10 *trett*
		39 . 1 . 21 . 2 *trett suttle*
		1 . 3 . 4 *cloff*
cwt.		39 . 0 . 17 . 14 *neat*

cwt. qr. lb.
46 . 3 . 14
2
3)93 . 3 . 0
31 . 1 . 0
cloff, *cwt.* 0 . 1 . $3\frac{1}{4}$

Because 14*lb.* is $\frac{1}{8}$*th* part of a hundred weight, $\frac{1}{8}$*th* of the gross subtracted from the gross leaves 41*cwt.* 1*lb.* 12*oz.* for neat weight, as there is no other allowance. But if 4*lb.* per 104*lb.* be allowed also for trett; then 41*cwt.* 0*qr.* 1*lb.* 12*oz.* would be called suttle, or tare suttle, and $\frac{1}{26}$ part thereof subtracted therefrom leaves 39*cwt.* 1*qr.* 21*lb.* 2*oz.* for neat weight, or trett suttle; if cloff 2*lb.* per 3*cwt.* gross had been also allowed; then 46*cwt.* 3*qr.* 14*lb.* the gross multiplied by 2 and divided by 3 gives 31*cwt.* 1*qr.*; but calling the cwts. pounds it is $31\frac{1}{4}$*lb.* or 1*qr.* $3\frac{1}{4}$*lb.* for cloff, which subtracted from 39*cwt.* 1*qr.* 21*lb.* 2*oz.* the trett suttle leaves 39*cwt.* 17*lb.* 14*oz.* for neat weight.—It is not customary to reckon cloff for any more than the whole *cwts.* nor any of the deductions further than pounds.

1*cwt.* 3*qr.* 26*lb*; tare in the whole 1*cwt.* 3*qr.* 5*lb*; what is the neat weight?

(5) Suppose 5 casks of raisins to weigh as follows, *viz.*

	cwt. qr. lb.		*lb.*
No. I gross weight	3 . 2 . 12	..... Tare	18
II.....	2 . 3 . 9	.....	16
III.....	4 . 1 . 17	.....	23
IV.....	5 . 0 . 8	.....	27
V.....	1 . 3 . 20	.....	14

what is the neat weight?

(6) In 3*cwt.* 1*qr.* 5*lb.* gross, tare 17*lb.* trett 4*lb. per* 104, what is the neat weight?

(7) In 4 casks weighing 29*cwt.* 1*qr.* 17*lb.* gross, tare 2*qr.* 10*lb. per cask*, trett 4*lb. per* 104, and cloff 2*lb. per* 3*cwt*, what is the neat weight?

(8) In 17*cwt.* 17*lb.* gross, tare 18*lb. per cwt*, trett 4*lb. per* 104, and cloff 2*lb. per* 3*cwt*, how much neat weight?

(9) Required the neat weight of 175*cwt.* 3*qr.* 17*lb.* gross, 18*lb. per cwt.* tare, trett, and cloff, as usual.

(10) Required the value at 22½*d. per lb.* of 31 bags of cotton, weighing 65*cwt.* 2*qr.* 14*lb.* gross, tare 25½*lb. per bag*.

(11) What is the neat weight of 6 casks of madder, each 4*cwt.* 2*qr.* 21*lb.* gross, tare 17*lb. per cwt?*

(12) Gross weight 363*cwt.* 2*qr.* 19*lb*, tare 21*lb. per cwt*, trett and cloff as usual, what is the neat weight?

(13) What is the value at 59*s.* 6*d. per cwt.* of 5 casks of gum, No. I. and II. weighing each 5*cwt.* 1*qr.* 15*lb*; No. IV., 4*cwt.* 2*qr.* 19*lb*; No. V. and VI., 11*cwt.* 1*qr.* 12*lb*, tare 13*lb. per cwt?*

(14) Bought a bag of cotton, weighing 4*cwt.* 3*qr.* 9*lb.* gross, tare 1*lb.* in 80*lb*, what does it come to at 15¼*d. per pound?*

(15) What will be the amount of 12 bags of Bowed cotton, each 4*cwt.* 1*qr.* 19*lb.* at 6⅞*d. per. lb*, allowing 1*lb. per bag* for draft in weighing, Liverpool tare 4*lb. per* 112*lb.*

(16) Bought 4 bales of American cotton, *viz.* 2*cwt.* 3*qr.* 8*lb*; 2*cwt.* 3*qr.* 4*lb*; 3*cwt.* 0*qr.* 10*lb*; and 2*cwt.* 2*qr.* 26*lb*; draft 1*lb. per* bale, and tare 4*lb. per cwt.* at 5⅜*d.* per *lb*; required their value.

(17) Given the gross weight 764*cwt.* 1*qr.* 27*lb.* tare 17½*lb. per cwt.* to find the neat weight, trett and cloff as usual.

(18) When the gross weight is 159*cwt.* 0*qr.* 15*lb.* tare 19½*lb. per cwt.* trett and cloff as before, what is the neat weight?

(19) In 6*hhds.* of tobacco, containing 56*cwt.* 2*qr.* 20*lb.* gross, tare 30*lb. per hhd*, trett 4*lb. per* 104, and cloff 2*lb. per* 3*cwt*, what will the neat weight come to at 7½*d. per lb?*

(20) Sold 15 bags of South Sea Islands cotton, each 2*cwt.* 1*qr*

23*lb.* at 9¼*d. per lb;* allowing 1*lb.* per bag for draft, Manchester tare 2½*lb. per* 100*lb;* required the amount.

(21) What will 50 bags of coffee come to at 14½*d. per lb,* each bag containing 17½*lb.* of coffee, tare 2½*lb. per bag?*

(22) The gross weight is 604*cwt.* 1*qr.* 25*lb,* tare 18¾*lb. per cwt,* trett and cloff as usual; required the neat weight.

(23) Sold 5 bales of East India cotton, *viz.* 3*cwt.* 0*qr.* 23*lb;* 3*cwt.* 1*qr.* 11*lb;* 2*cwt.* 3*qr.* 26*lb;* 3*cwt.* 1*qr.* 14*lb;* 2*cwt.* 3*qr.* 20*lb;* at 5¼*d. per lb,* allowing 8*lb.* on each bale for ropes, 1*lb. per bale* for draft, and tare 4*lb. per* 112*lb;* what do they come to?

(24) What will be the neat weight, when the tare is 22¾*lb. per cwt,* trett and cloff as usual, gross weight being 564*cwt.* 3*qr.* 22*lb?*

(25) In 4 casks of gum, weighing, No. V. and VII., 6*cwt.* 1*qr.* 17*lb;* No. VIII., 4*cwt.* 2*qr.* 16*lb;* No. IX., 5*cwt.* 3*qr.* 9*lb.* gross, tare 13*lb. per cwt,* how much neat weight, and what do they come to at 63*s.* 6*d. per cwt?*

(26) What is the value of 6*hhds.* of sugar, at 7½*d. per lb,* each weighing 9*cwt.* 3*qr.* 17*lb.* gross, tare 1*cwt.* 2*qr.* 2*lb. per hhd,* trett and cloff according to custom?

(27) Find the neat weight, when the gross is 674*cwt.* 2*qr.* 19*lb,* tare 25½*lb. per cwt,* trett and cloff as usual.

(28) What will be the value of 25 bales of American cotton, weighing 73*cwt.* 0*qr.* 16*lb.* at 5½*d. per lb,* allowing 1*lb.* on each bale for draft, and 4*lb. per* 112*lb.* for tare?

(29) Given the gross weight 397*cwt.* 3*qr.* 16*lb,* tare 32*lb. per cwt,* trett and cloff as usual, to find the neat weight.

(30) A cask of wine weighs 16*cwt.* 2*qr.* 11*lb.* gross, tare 18*lb. per cwt,* what will it come to at 7*s.* 9*d.* per gallon, allowing a gallon to weigh 7½*lb?*

(31) Find the value of 20 bales of East India cotton, weighing 62*cwt.* 1*qr.* 23*lb,* allowing 8*lb.* per bale for ropes, 1*lb.* per bale for draft, and tare 4*lb.* per 112*lb,* at 5⅛*d. per lb.*

(32) Bought in Virginia 22*hhds.* of tobacco, each 26*cwt.* 15*lb,* at 2¼*d. per lb,* charges of shipping 2*l.* 12*s.* 6*d,* freight 22*s. per hhd,* what do they cost me, having 1*cwt.* 15*lb. per hhd.* allowed for tare?

(33) When the gross weight is 461*cwt.* 1*qr.* 20*lb,* tare 36½*lb. per cwt,* trett and cloff as usual, to find the neat weight.

(34) Required the value at 7⅝*d. per lb.* of 30 bales of American cotton, weighing 110*cwt.* 0*qr.* 8*lb,* deducting 1*lb.* per bale for draft, and Manchester tare 2½*lb.* per 100*lb.*

(35) Bought 2 casks of oil, each 10*cwt.* 2*qr.* 3*lb.* and 10*cwt.* 2*qr.* 6*lb,* tare 18*lb. per cwt.* of 112*lb,* what will they come to at 4*s.* 3*d. per gallon,* allowing an imperial gallon to weigh 9*lb?*

(36) A grocer bought 13*cwt.* 2*qr.* 6*lb.* of sugar, at 84*s.* 2*d.* *per cwt*, which he retailed at $6\frac{1}{2}d.$ *per lb;* what did he gain or lose by it, and what *per lb*, tare 11*lb. per cwt?*

(37) In 10 bales of Bourbon cotton, weighing 25*cwt.* 2*qr.* 6*lb*, draft 1*lb.* per bale, and tare 4*lb. per cwt;* what will the neat weight come to at 1*s.* 2*d. per lb?*

(38) Bought a bag of cotton at $15\frac{3}{4}d.$ *per lb.* weighing 3*cwt.* 1*qr.* 22*lb.* gross, tare 1*lb.* in 70, I sold it again at $17\frac{1}{4}d.$ *per lb*, allowing tare 3*qrs.* of a pound in 70*lb;* what was my gain?

(39) Bought 17 bags of South Sea Islands cotton, at $9\frac{3}{8}d.$ *per lb*, each 2*cwt.* 2*qr.* 15*lb*, deducting 1*lb. per bag* for draft, Liverpool tare 4*lb. per* 112*lb;* what shall I gain or lose by selling them again at $9\frac{1}{8}d$, Manchester tare $2\frac{1}{2}lb.$ *per* 100*lb?*

(40) Required the value of 3 casks of oil, *viz.* 11*cwt.* 1*qr.* 7*lb;* 10*cwt.* 2*qr.* 8*lb;* and 10*cwt.* 3*qr.* 21*lb;* tare 18*lb. per* 112*lb*, at 50*l.* 8*s. per tun*, of 252 gallons; a gallon weighs 9*lb.*

BARTER.

Barter teaches to exchange commodities or wares without loss, and is performed by the Rule of Three.

EXAMPLES.

(1) How much sugar at $4\frac{1}{2}d.$ per pound, will purchase a puncheon of rum, worth 15*l.* 1*s?*

(2) How many pairs of stockings at 2*s.* 4*d. per pair*, must be given for 46 yards of cloth, at 8*s.* 9*d. per yard?*

(3) How much incle at 3 yards a penny, will pay for 14*cwt.* 3*qr.* 14*lb.* of sugar, at 53*s.* 6*d. per cwt?*

It may be necessary to observe, that when the bartering price and ready money price are different, the ready money price of one quantity is to its bartering price, as the ready money price of the other is to its bartering price. *Example:* T has cotton wool at 20*d. per lb.* ready money, but in barter with W, he values it at 2*s.* W has calico at 15*d. per yard*, ready money, how must he advance it to be equal to T's cotton wool? 20*d.* : 24*d.*::15*d.* : 18*d.* the bartering price of the calico. *Again,*

Bob and Ben barter—Bob has 36 gallons of ale at 12*d. per gallon*, ready money, but in barter with Ben for porter, he values it at 15*d. per gallon.* Ben's porter is 18*d. per gallon*, ready money, how must he charge it in barter, and what quantity must he give Bob for his ale?

36 gallons of ale at the bartering price, 15*d.* come to 45*s.* : 12*d.* : 15*d.*::18*d.* : $22\frac{1}{2}d.$; the bartering price of the porter $22\frac{1}{2}d.$: 1*g.*::45*s* : 24*gals.* of porter.

(4) Two men, A and B, barter; A has 46 yards of kersey at 2*s.* 9*d. per yard*, B has 16 dozen of handkerchiefs at 5*s.* 10*d. per dozen*, and they desire to know whether must pay money, and how much.

(5) A has 480*lb.* of cotton wool, at 15*d. per pound*, ready money, but in barter he will have $16\frac{1}{2}d.$ *per pound;* B has plain cloth at 5*s. per yard*, ready money, and desires to know how he must charge it in barter, also how many yards he must give for A's cotton wool.

(6) If 24*cwt.* of tobacco, at 1*l.* 18*s. per cwt*, be given for 100*yds.* of cloth, what is the value of the cloth *per yard?*

(7) If I give 37*l.* 16*s.* for 144 ducats, what is the value of a ducat?

(8) A has 92 yards of broad cloth at 15*s. per yard*, for which B is to give him 120 gallons of rum at 9*s. per gallon*, and the rest in British compounds, at 3*s.* 9*d. per gallon*, how much compound must A receive?

(9) A farmer has 162 stones of wool, at 8*s.* 2*d. per stone*, and wishes to know how many pieces of cloth, each 28 yards, at 4*s.* 1*d. per yard*, it will purchase?

(10) Sent to Jamaica 251 pieces of muslinet, each $50\frac{1}{4}yds.$ at $17\frac{3}{4}d$, and 365 pieces of nankeens, each 28*yds.* at $15\frac{3}{4}d.$ *per yard*, how many bags of cotton, each 3*cwt.* 1*qr.* 5*lb.* at $15\frac{3}{4}d.$ *per lb*, may I have for it?

(11) C D and G W exchange goods; C D has 31 pieces of Irish linen, each $25\frac{1}{2}yds.$ at 2*s.* 3*d. per yard*, for which G W gives him 16 pieces of flannel, each $48\frac{1}{4}yds.$ at 23*d. per yard*, which of them gain?

GAIN AND LOSS.

This rule teaches to calculate the gain or loss in trading, and is no more than an application of the Rule of Three.

EXAMPLES.

(1) If I buy yarn at 10*d. per lb.* and sell it again at $12\frac{1}{4}d.$ *per lb*, what do I gain *per cent?*

Gain and loss are generally reckoned by the 100*l.* Goods are sold so as to gain or lose so much *per centum*, or *per cent*, that is, by the sale of 100*l.* worth. In working questions under this rule, the learner frequently mistakes the gain *per cent* for the amount of the cost and gain, that is, the price sold for. But he must remember, that if he lay out 100*l.* in goods, and by the sale of them gain 10*l.*, when they are sold he will have 110*l. viz.* the 100*l.* cost and the 10*l.* gained. And if on laying out 100*l.* and by the sale he loses 10*l.*, when sold he will only have 90*l.* In the former case, 110*l.* is the price sold for, and in the latter, 90*l.* is the price sold for.

(2) If I buy yarn at 10*d.* *per pound*, how must I sell it *per pound* to gain 25*l.* *per cent?*
(3) What must I give *per pound* for yarn to sell it again at 12½*d.* *per pound*, and gain 25*l.* *per cent?*
(4) If I buy a *cwt.* of tobacco for 6*l.* 4*s.* and sell it again at 16½*d.* *per lb*, what do I lose or gain *per cent?*
(5) If, by selling cloth at 18*s.* *per yard*, I gain 20*l.* *per cent*, what did it cost me?
(6) If I gain 6*l.* *per cent* by selling cloth at 4*s.* 5*d.* *per yard*, what shall I gain *per cent* if I sell the same cloth at 5*s.* 3*d.* *per yard?*
(7) Sold cloth at 4*s.* 5*d.* *per yard*, and gained 6*l.* *per cent*, how must I sell the same cloth to gain 18*l.* *per cent?*
(8) Bought 1 *cwt.* of sugar for 2*l.* 12*s.* which, not proving so good as I expected, I am willing to lose 8*l.* *per cent*, how must I sell it *per lb?*
(9) By selling cloth at 7*s.* 10*d.* *per yard*, I found that I lost 6*l.* *per cent*, what must I sell the same cloth for *per yard*, to gain 18*l.* *per cent?*
(10) How must I buy cloth to sell at 10*s.* *per yard*, and to gain 20*l.* *per cent?*
(11) If I buy sugar for 4*l.* 3*s.* 4*d.* *per cwt.* and sell it again at 10½*d.* *per pound*, what do I gain *per cent?*
(12) If I buy sugar for 4*l.* 3*s.* 4*d.* *per cwt*, how must I sell it *per pound*, to gain 17*l.* 12*s.* *per cent?*

EXAMPLE.—If I give 2*s.* for a book and sell it again for 2*s.* 6*d.*, what do I gain *per cent?* 2*s.* : 2*s.* 6*d.* :: 100*l.*; 125*l.* the amount of 100*l.* And 125—100=25*l.* gain *per cent.*

Gave 2*s.* for a book, how much must I sell it for to gain 25*l.* *per cent?* 100*l.* : 125*l.* :: 2*s.* : 2*s.* 6*d.* the price to be sold for.

Sold a book for 2*s.* 6*d.* and gained after the rate of 25*l.* *per cent*, what did it cost me? 125*l.* : 100 :: 2*s.* 6*d.* : 2*s.* cost.

Gave 12*d.* for a knife, and sold it again for 9*d.*, what did I lose *per cent?* 12*d.* : 9*d.* :: 100*l.* : 75*l.* And 100—75=25 *per cent* loss.

Gave 12*d.* for a knife, for how much must I sell it to lose no more than 25*l.* *per cent?* 100*l.* : 75*l.* :: 12*d.* : 9*d.* price to be sold for.

If I gain 20 *per cent* by selling cloth at 6*s.* *per yard*, what shall I gain *per cent* if I sell it at 6*s.* 6*s.* *per yard?* 6*s.* : 120*l.* :: 6*s.* 6*d.* : 130*l.* And 130—100=30 *per cent.*

If, by selling cloth at 6*s.* *per yard*, I lose 10*l.* *per cent*, how must I sell it *per yard* to gain 10*l.* *per cent?* 90*l.* : 6*s.* :: 110*l.* : 7*s.* 4*d.* *per yard.*

The following observations may, in some cases, render reduction unnecessary; when the first and second terms are of the same denomination, the third and fourth will be so too.

It is worthy of remark, that a person may actually gain from *cent per cent* to 500*l.* *per cent*, or even more; but how much can a person *actually lose more than cent per cent?*

(13) What must I give for 1*cwt.* of sugar to sell again at 10½*d.* *per lb.* and gain 17*l.* 12*s.* *per cent?*

(14) Sold sugar at 4*l.* 3*s.* 4*d.* *per cwt.* and lost 17*l.* 12*s.* *per cent*, what did it cost me?

(15) If I buy sugar at 4*l.* 18*s.* *per cwt.* and sell it again at 4*l.* 3*s.* 4*d.* *per cwt*, what do I lose *per cent?*

(16) If by selling sugar at 4*l.* 3*s.* 4*d.* *per cwt.* I lose 17*l.* 12*s.* *per cent*, how must I sell it to gain 8*l.* 6*s.* 8*d.* *per cent?*

(17) If by selling sugar at 4*l.* 3*s.* 4*d.* *per cwt.* I lose 17*l.* 12*s.* *per cent*, what shall I gain or lose *per cent*, if I sell the same at 5*l.* 6*s.* 2*d.* *per cwt?*

(18) By selling wool at 13*s.* *per stone*, I lost 15*l.* *per cent*, what did it cost me?

(19) I lost 5*l.* *per cent* by selling sugar at 85*s.* *per cwt*, how must I sell it *per cwt.* to gain 12½*l.* *per cent?*

(20) How must I buy cotton to sell at 17½*d.* *per lb.* and gain 25*l.* *per cent?*

SIMPLE INTEREST.

When interest is not allowed for interest unpaid, the interest is called simple interest.

Principal is the money lent.

Interest is the money paid for the loan of money.

Rate is the interest of 100*l.* for one year.

Amount is the sum of both principal and interest.

Time is the number of years and parts of a year for which interest is allowed.

RULE.

I.—The interest of any sum at any rate per cent, for one or more years, is found by the Rule of Three. The interest added to the principal is the amount.

EXAMPLES.

(1) Required the interest of 240*l.* for one year, at 4*l.* *per cent;* that is, to receive 4*l.* for every 100*l.* that you lend, 100*l.* : 4*l.* :: 240*l.* : 9*l.* 12*s.* the interest, of money you would receive for lending 240*l.* for one year, at 4*l.* for 100*l.* or at 4*l.* *per cent.*

(2) What will 250*l.* amount to at 4*l.* *per cent*, for one year? 100*l.* : 4*l.* :: 250*l.* : 10*l.* interest, for one year, and 250*l.* principal added to 10*l.* interest, gives 260*l.* the amount, or the sum that 250*l.* would amount to in one year.

(3) Required the interest of 260*l.* for 4½ years at 4*l.* *per cent per annum.* Find the interest of 260*l.* for one year: and the interest for one year multiplied by the number of years, will give 46*l.* 16*s.* the interest for 4½ years.

(4) What will 380*l.* 15*s.* 6*d.* amount to in $6\frac{3}{4}$ years at $4\frac{1}{2}$*l. per cent per annum?* Find the interest for $6\frac{3}{4}$ years. Then this interest added to the principal gives 496*l.* 8*s.* $7\frac{1}{2}$*d.* the amount, or the sum that 380*l.* 15*s.* 6*d.* would amount to in $6\frac{3}{4}$ years.

II.—When the interest, rate, and time are given, to find the principal. Find the interest of 100*l.* for the time; then as that interest is to 100*l.* so is the given interest to the principal required. When the amount is given, say, as the amount of 100*l.* for the time is to 100*l.* so is the given amount to the principal required.

(5) What sum or what principal will gain 48*l.* interest in 4 years, at 4*l. per cent per annum?* First say, what is the interest of 100*l.* for one year, and afterwards for 4 years? which will be 16*l.*, then 16*l.* : 100*l.* :: 48*l.* : 300*l.* the principal required.

(6) What sum or principal will amount to 540*l.* in 5 years, at 4*l. per cent per annum?* First, find the amount of 100*l.* for 5 years, which will be 120*l.*, and then, as 120*l.* : 100*l.* :: 540*l.* : 450*l.* the principal or sum required.

III.—When the principal, rate, and interest, or amount, are given, to find the time. Find the interest of the given principal for one year, by which divide the whole interest, and the quotient is the time. The difference between the principal and the amount is the whole interest.

(7) In what time will 806*l.* 17*s.* 6*d.* gain 161*l.* 7*s.* 6*d.* at 4*l. per cent per annum?* The interest of 806*l.* 17*s.* 6*d.* for one year is 32*l.* 5*s.* 6*d.*, then as 32*l.* 5*s.* 6*d.* : 1*y.* :: 161*l.* 7*s.* 6*d.* : 5 years, the time.

(8) In what time will 480*l.* amount to 576*l.* at 4*l. per cent per annum?* The interest of 480*l.* for one year is 19*l.* 4*s.*, also the difference between 576*l.* and 480*l.* gives 96*l.* the whole interest, then 19*l.* 4*s.* : 1*y.* :: 96*l.* : 5 years, the time.

IV.—When the principal, time, and interest, or amount, are given, to find the rate. The whole interest divided by the time gives the interest of the principal for one year; and as the principal to the interest thereof for one year, so is 100*l.* to the rate *per cent.*

(9) At what rate *per cent* will 960*l.* gain 192*l.* in 5 years? Divide 192*l.* by 5 years, and the quotient 38*l.* 8*s.* will be the interest of the principal 960*l.* for one year, then as 960*l.* : 38*l.* 8*s.* :: 100*l.* : 80*s.* or 4*l.* the rate *per cent.*

(10) At what rate *per cent* will 360*l.* amount to 460*l.* 16*s.* in 7 years? The difference between 460*l.* 16*s.* and 360*l.* will be 100*l.* 16*s.* the whole interest, and this divided by 7

years will give 14*l.* 8*s.* the interest for one year, then 360*l.* : 14*l.* 8*s.* :: 100*l.* : 80*s.* or 4*l.* the rate *per cent.*

Note.—When interest is at 5*l. per cent*, 5 being $\frac{1}{20}$ of 100, $\frac{1}{20}$ of the principal is the interest, *viz.* 246÷20=12*l.* 6*s.*; or when the rate is 5*l. per cent*, the interest is 1*s. per pound per year*, or 1*d. per pound per month;* then if you call the pounds shillings, they will be the interest for one year, or call them pence, and they will be the interest for one month, either of which may be reduced to pounds by the common rule in reduction.

EXAMPLES.

(11) What interest will 265*l.* gain in one year, at 4*l. per cent per annum*, simple interest?

(12) What will 246*l.* 10*s.* gain in one year, at 5*l. per cent per annum?*

(13) What will 265*l.* gain in 7 years, at 4*l. per cent per annum?*

(14) What will 246*l.* 10*s.* gain in 7 years, at 5*l. per cent per annum?*

(15) What will 340*l.* amount to in 12 years, at 5*l. per cent per annum?*

(16) What sum will 720*l.* gain in $4\frac{1}{2}$ years, at 4*l. per cent per annum?*

(17) What sum will amount to 63*l.* in 3 years, at 4*l. per cent per annum?*

(18) What will 308*l.* 2*s.* 6*d.* amount to in 12 years, at 4*l. per cent per annum?*

(19) What sum will gain 129*l.* 12*s.* in $4\frac{1}{2}$ years, at 4*l. per cent per annum?*

(20) What sum will amount to 52*l.* 18*s.* in 3 years, at 5*l. per cent per annum?*

(21) In what time will 240*l.* gain 48*l.* 9*s.* at the rate of 4*l.* 5*s. per cent per annum?*

(22) In what time will 184*l.* amount to 248*l.* 8*s.* at the rate of 5*l. per cent per annum?*

(23) In what time will 181*l.* 5*s.* amount to 217*l.* 10*s.* at 4*l. per cent per annum?*

(24) At what rate will 46*l.* amount to 55*l.* 4*s.* in 4 years?

(25) What sum will gain 56*l.* in 5 years, at 4*l. per cent per annum?*

(26) What principal will amount to 364*l.* 2*s.* 6*d.* in $4\frac{1}{2}$ years, at $4\frac{3}{4}$*l. per cent per annum?*

(27) At what rate will 78*l.* 2*s.* 6*d.* amount to 90*l.* 12*s.* 6*d.* in 4 years?

(28) How much interest will 145*l.* 16*s.* gain in $4\frac{3}{4}$ years, at 5*l. per cent per annum?*

(29) What sum will gain 13*l.* 16*s.* interest in 6 years, at 5*l. per cent per annum?*

(30) In what time will 340*l.* amount to 432*l.* 4*s.* 6*d.*, at the rate of 3*l.* 10*s.* *per cent per annum?*

(31) How much interest will 170*l.* 4*s.* 2*d.* gain in $4\frac{3}{4}$ years, at 4*l.* *per cent per annum?*

(32) At what rate of interest will 240*l.* amount to 304*l.* 16*s.* in 6 years?

(33) How much interest will 720*l.* gain in 4 years and 7 months, at $4\frac{1}{2}$*l.* *per cent per annum?*

(34) In what time will the interest of 1*l.* amount to 15*s.* at $4\frac{1}{2}$*l.* *per cent per annum?*

(35) How much interest will 345*l.* 10*s.* gain in 7 years and 7 months, at $4\frac{1}{4}$*l.* *per cent per annum?*

(36) What sum will amount to 130*l.* 19*s.* in $9\frac{3}{4}$ years, at 4*l.* 15*s.* *per cent per annum?*

(37) What will be the interest of 542*l.* 2*s.* for 30 weeks, at 5*l.* *per cent per annum?*

(38) What is the interest of 480*l.* 17*s.* 6*d.* for 65 days and 49 days, at 5*l.* *per cent per annum?*

(39) What is the interest of 327*l.* 14*s.* for $7\frac{1}{2}$ months, at 5*l.* *per cent per annum?*

(40) What will 346*l.* 18*s.* amount to in 3 years, 5 months, and 10 days, at $4\frac{1}{2}$*l.* *per cent per annum* *?

(41) How much interest will 2347*l.* 10*s.* gain in $17\frac{1}{2}$ years, at 5*l.* *per cent*, $4\frac{3}{4}$*l.*, $4\frac{1}{2}$*l.*, $4\frac{1}{4}$*l.*, and 4*l.* *per cent?*

Discount is calculated as interest, and is an abatement allowed for the payment of money before it is due †.

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* In calculating interest, 30 days are a month.

† In mercantile transactions, it is usual to deduct the simple interest of the debt for the time: but though this may save a little time in calculation, it is not just. For, the true discount being the difference between the debt and its present worth, discount is only the interest of that present worth, instead of the interest on the whole debt. Wherefore, as the amount of 100*l.* for the given rate and time is to the interest of 100*l.* for that time, so is the given sum or debt to the discount of the debt. And as the amount of 100*l.* for the time is to 100*l.* so is the debt to its present worth:—

EXAMPLE.—Required the discount and present value of 120*l.* due in 12 months, at 5*l.* *per cent.*

105 : 5*l.* :: 120*l.* : 5*l.* 14*s.* $3\frac{1}{4}$*d.* *discount.*

And 105*l.* : 100*l.* :: 120*l.* : 114*l.* 5*s.* $8\frac{3}{4}$*d.* *present value.*

Now the interest of 114*l.* 5*s.* $8\frac{3}{4}$*d.* at 5*l.* per cent for a year, is 5*l.* 14*s.* $3\frac{1}{4}$*d.* which added to 114*l.* 5*s.* $8\frac{3}{4}$*d.* makes 120*l.* This proves the principle of the rule.

If the above example be discounted by the mercantile method, the discount will be 6*l.* which is too much; but as the mercantile method is universally adopted, boys may not be improperly accustomed to it.

(42) Required the discount of 350*l.* 15*s.* 6*d.* for 3 months, at $2\frac{1}{4}$*l. per cent.*

(43) What is the discount on 640*l.* 10*s.* due in one year, allowing 5*l. per cent per annum?*

(44) What is the discount and present worth of 247*l.* 10*s.* due in $2\frac{3}{4}$ years, at 5*l. per cent per annum?*

(45) What is the discount on a bill of 126*l.* due in 3 months, at 8*l. per cent per annum?*

(46) What is the discount on 426*l.* 10*s.* due in 2 months and 12 days, at 5*l. per cent per annum?*

(47) What is the discount on 748*l.* 15*s.* for $2\frac{1}{4}$ months, at 5*l. per cent per annum?*

(48) A person owes 760*l.* due at 5 months, required the discount at $2\frac{1}{2}$*l.*, $3\frac{1}{2}$*l.*, and 5*l. per cent.*

Commission and brokerage are money paid for negotiating or transacting business for another.

Insurance is money paid for insuring property.

They are all reckoned as interest of money for one year.

EXAMPLES.

(49) What is the commission on the sale of goods to the amount of 246*l.* 10*s.* at 5*l. per cent?*

(50) A factor bought goods for his employer to the amount of 967*l.* 15*s.* and charges $2\frac{1}{2}$*l. per cent* commission; what will be the amount of his invoice?

(51) What will the insurance of a ship and cargo come to, which is valued at 8426*l.* at $1\frac{3}{4}$*l. per cent?*

(52) What does the insurance of a ship, valued at 3216*l.* 10*s.* come to, at 2*l.* 3*s.* 4*d. per cent?*

(53) A factor bought goods to the value of 347*l.* 14*s.* 6*d.* and charges $2\frac{1}{2}$*l. per cent* commission, what is the amount of his invoice?

(54) Sold 50 pieces of muslinet, each $51\frac{1}{2}$*yds.* at $17\frac{1}{2}$*d. per yd.* and 15 pieces of dimity at 18*s.* 6*d. per piece;* what will my commission amount to, at $2\frac{3}{4}$*l. per cent?*

(55) Bought for A B, 5*hhds.* of tobacco, weighing 19*cwt.* 2*qr.* 15*lb.* gross, tare 13*lb. per cwt.* at $17\frac{1}{2}$*d. per lb;* what will my commission amount to, at $1\frac{1}{4}$*l. per cent?*

(56) At 2*l. per cent* my commission amounted to 30*l.*; what was the value of the goods sold?

(57) My employer has paid me 17*l.* 10*s.* for selling goods to the amount of 500*l.*; how much is my commission *per cent?*

(58) Required the interest at $4\frac{1}{2}$*l. per cent* of 450*l.* 16*s.* 3*d.* from the 3*rd* of January to the 15*th* of September following.

(59) What will be the interest of 375*l.* 13*s.* 9*d.* from the 5*th* of April, 1843, to the 15*th* of February, 1844, at $4\frac{3}{4}$*l. per cent?*

(60) What will be the interest at $4\frac{1}{4}l.$ *per cent* of 293*l.* 9*s.* 2*d.* from the 2*nd* of March, 1844, to the 21*st* of January following?

SIMPLE INTEREST FOR DAYS,

AT 5*l.* PER CENT.

An expeditious method of calculating the interest of any sum of money, for a given number of days, when interest is at 5*l.* per cent.

RULE.

Multiply the pounds by the days, and call the product shillings.—Take parts for the shillings and pence out of the days, divide by 365, the quotient will be the answer in shillings, and if any thing remain, proceed as in compound division.

EXAMPLES.

(1) What is the interest of 350*l.* 15*s.* for 30 days, at 5*l.* *per cent per annum*, simple interest?

s.		350*l.* . 15*s.*
10	$\frac{1}{2}$	30
		10500
5	$\frac{1}{2}$	15
		7 . 6*s.*
		(20

365)10522 . 6(28*s.* $9\frac{3}{4}d.$ interest for 30 days.

1*l.* 8*s.* $9\frac{3}{4}d.$

(2) Required the interest of 566*l.* 17*s.* 6*d.* in 65 days, at 5*l.* *per cent.*

(3) What interest will 674*l.* 16*s.* 6*d.* gain in 69 days, at 5*l.* *per cent?*

(4) What will be the interest of 250*l.* 18*s.* 6*d.* for 48 days, at 5*l.* *per cent?*

(5) Find the interest of 61*l.* 12*s.* 6*d.* for 15 days; of 191*l.* 11*s.* 6*d.* for 54 days; and of 76*l.* 13*s.* 6*d.* for 36 days, at 5*l.* *per cent.*

(6) Lent 506*l.* 12*s.* for 42 days, 351*l.* 15*s.* 6*d.* for 51 days, and 42*l.* 14*s.* 6*d.* for 28 days; what interest shall I have to receive for the whole at 5*l.* *per cent?*

COMPOUND INTEREST.

When interest is allowed for interest remaining in the borrower's hands, such is called compound interest.

Compound interest is more easily calculated by decimals, and still more so by the help of logarithms.

A TABLE OF THE AMOUNT.

£100,000 for ten years, at 3*l*., 3½*l*., 4*l*., 4¼*l*., 4½*l*., 4¾*l*., and 5*l*. *per cent per annum*, compound interest.

yrs.	3 *per cent.*	3½ *per cent.*	4 *per cent.*	4¼ *per cent.*	4½ *per cent.*	4¾ *per cent.*	5 *per cent.*
¼	1·00741	1·00863	1·00986	1·01046	1·01106	1·01166	1·01227
½	1·01488	1·01735	1·01980	1·02003	1·02225	1·02247	1·02469
¾	1·02242	1·02914	1·02985	1·03170	1·03356	1·03541	1·03727
1	1·03000	1·03500	1·04000	1·04251	1·04500	1·04750	1·05000
2	1·06081	1·07122	1·08160	1·08680	1·09202	1·09723	1·10250
3	1·09272	1·10872	1·12487	1·13299	1·14114	1·14937	1·15762
4	1·12551	1·14753	1·16983	1·18114	1·19252	1·20397	1·21551
5	1·15927	1·18769	1·21665	1·23134	1·24618	1·26116	1·27628
6	1·19405	1·22925	1·26532	1·28664	1·30223	1·32106	1·34010
7	1·22987	1·27227	1·31593	1·33824	1·36086	1·38382	1·40710
8	1·26674	1·31681	1·36851	1·39511	1·42210	1·44554	1·47745
9	1·30176	1·36289	1·42331	1·45440	1·48610	1·51140	1·55132
10	1·34392	1·41060	1·48027	1·51625	1·55297	1·59052	1·62890

The principal, rate, and time given, to find the amount.

Find the amount for one year according to simple interest and the amount of that amount for one year, and so on, making every year's amount the principal for the succeeding year until you have gone through the number of years required, the last amount will be that required.

Or, multiply the amount of 100,000*l*. at the rate and time required, as found in the table, and divided by 100,000*l*. the

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What will 800*l*. amount to in 4 years at 5*l*. per cent per annum, compound interest?

According to simple interest, as 100*l*. : 105*l*. :: 800*l*. : 840*l*. the first year's amount, and as 100*l*. : 105*l*. :: 840*l*. : 882*l*. the second year's amount, as 100*l*. : 105*l*. :: 882*l*. : 926*l*. 2*s*. the third year's amount, then as 100*l*. : 105*l*. :: 926*l*. 2*s*. : 972*l*. 8*s*. 1¾*d*. the fourth year's amount, as required.

Or, by the table, the amount of 100,000*l*. in 4 years, at 5*l*. *per cent*, is 121,551*l*., wherefore as 100,000*l*. : 121,551*l*. :: 800*l*. : 972*l*. 8*s*. 1¾*d*. the amount as before.

If the interest had been required, 972*l*. 8*s*. 1¾*d*.—800*l*.=172*l*. 8*s*. 1¾*d*. Or, if the first figure in the tabular amount be omitted, the remainder will be the interest; thus, as 100,000*l*. : 121,551*l*. :: 800*l*. : 172*l*. 8*s*. 1¾*d*. the interest required.

What sum of money will amount to 972*l*. 8*s*. 1¾*d*. in four years, at 5*l*. *per cent per annum*, compound interest?

quotient will be the required amount.—If the time exceed the limits of the table, you may find the amount for 10, or any other number of years in the table, and then the amount of that amount for the remaining time.

EXAMPLES.

(1) What will 240*l.* amount to in three years, at 5*l. per cent per annum*, compound interest?

(2) What is the compound interest of 146*l.* 10*s.* for five years, at 4*l. per cent per annum?*

(3) What will 346*l.* 10*s.* amount to in $6\frac{1}{2}$ years at $4\frac{1}{2}$*l. per cent per annum*, compound interest?

(4) What will 265*l.* amount to in fifteen years, at 5*l. per cent per annum*, compound interest?

The amount, rate, and time given, to find the principal.

Find the amount of 100*l.* for the given time at the given rate, then say as that amount is to 100*l.* so is the given amount to the required principal. Or,

As 100*l.* with the rate per cent added is to 100*l.*, so is the given amount to the principal, which will give that amount in one year.—Repeat this proportion as oft as there are years in the time, and for a part of a year take such part of the given rate to add to 100*l.* for the first term, and work as before. Or,

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First find the amount of 100*l.* in four years at 5*l.* per cent, as in the first case, which will be 121*l.* 11*s.* $0\frac{1}{4}$*d.*; then as 121*l.* 11*s.* $0\frac{1}{4}$*d.* : 100*l.* :: 972*l.* 8*s.* $1\frac{3}{4}$*d.* : 800*l.* Or, as 105*l.* : 100*l.* :: 972*l.* 8*s.* $1\frac{3}{4}$*d.* : 926*l.* 2*s.* $1\frac{1}{2}$*d.* the amount in three years.

105*l.* : 100*l.* :: 926*l.* 8*s.* $1\frac{3}{4}$*d.* : 882*l.* the amount in two years.

105*l.* : 100*l.* :: 882*l.* : 840*l.* the amount in one year.

105*l.* : 100*l.* :: 140*l.* : 800*l.* the principal required.

Instead of 105*l.* : 100*l.* you may take 21 : 20, which is the same ratio.

Or, the amount in the table is 121,551*l.*, wherefore, as 121,551*l.* : 100,000*l.* :: 972*l.* 8*s.* $1\frac{3}{4}$*d.* : 800*l.* the principal as before.

In what time will 800*l.* amount to 972*l.* 8*s.* $1\frac{3}{4}$*d.* at 5*l. per cent per annum*, compound interest?

As 100*l.* : 105*l.* :: 800*l.* : 840*l.* the first year's amount.

100*l.* : 105*l.* :: 840*l.* : 882*l.* the second year's amount.

100*l.* : 105*l.* :: 882*l.* : 926*l.* 2*s.* $0\frac{1}{2}$*d.* the third year's amount.

100*l.* : 105*l.* :: 926*l.* 2*s.* $0\frac{1}{2}$*d.* : 972*l.* 8*s.* $1\frac{3}{4}$*d.* the fourth year's amount, which is the given amount, wherefore the time is four years.

If there had been part of a year, subtract the last found amount from the required amount, the remainder will be the interest of, or part of a year wanting, and find the whole year's interest of the last found amount, then as one year's interest is to one year, so is any part of a year's interest to the part of a year required very nearly. Or by the *table*.

As 800*l.* : 972*l.* 8*s.* $1\frac{3}{4}$*d.* :: 100,000*l.* : 121,551*l.* the *tabular* amount, which found under 5*l. per cent*, will stand against four years as before.

Find the amount of 100,000*l.* for the given time at the given rate by the table; then say, as that amount is to 100,000*l.*, so is the given amount to the required principal.

EXAMPLES.

(5) What sum of money will amount to 277*l.* 16*s.* $7\frac{1}{4}d.$ in three years, at 5*l. per cent per annum?*

(6) What sum will gain 31*l.* 15*s.* 6*d.* compound interest in five years, at 4*l. per cent per annum?*

(7) What sum of money will amount to 461*l.* 7*s.* 6*d.* in $6\frac{1}{2}$ years, at $4\frac{1}{2}$*l. per cent per annum*, compound interest?

Principal, amount, and rate given, to find the time.

Find the amount of the given principal for one year, and of that sum for another year, and so on continually till it arise to the given amount, then the time will be known by the number of operations. Or,

Multiply the given amount by 100,000*l.*, divide the product by the principal, *viz.* as the given principal is to the amount, so is 100,000*l.* to the tabular amount, which found under the given rate, will stand against the time.

EXAMPLES.

(8) In what time will 240*l.* amount to 277*l.* 16*s.* $7\frac{1}{2}d.$ at 5*l. per cent per annum*, compound interest?

(9) In what time will 146*l.* 10*s.* gain 31*l.* 15*s.* 6*d.* compound interest, at 4*l. per cent per annum?*

(10) In what time will 346*l.* 10*s.* amount to 461*l.* 7*s.* 6*d.* at $4\frac{1}{2}$*l. per cent per annum*, compound interest?

Principal, time, and amount given, to find the rate.

Because the roots of all powers are too difficult to extract without the use of logarithms, I shall only here give the following method by the table.

If 100*l.* be lent for 5*l.* a year interest, it is equal whether that 5*l.* a year be considered as an annuity or the interest of 100*l.* And the compound interest of 100*l.* at 5*l. per cent per annum* in three years, is 15*l.* 15*s.* $2\frac{4}{5}d.$; hence the amount of an annuity of 5*l. per annum* in three years, allowing compound interest at 5*l. per cent*, is 15*l.* 15*s.* $2\frac{4}{5}d.$; and if the present worth of such annuity be required, it is only to find the present worth of 15*l.* 15*s.* $2\frac{4}{5}d.$ due in three years, and because 100*l.* will amount to 105*l.* 15*s.* $2\frac{4}{5}d.$ in three years, at 5*l. per cent*, as 115*l.* 15*s.* $2\frac{4}{5}d.$: 100*l.* :: 15*l.* 15*s.* $2\frac{4}{5}d.$: 13*l.* 12*s.* $1\frac{3}{4}d.$ the present worth required.

If the amount, rate, and time, be given to find the annuity, it is the same thing as having the interest, rate, and time given, to find the principal; the yearly interest of that principal is the annuity. And this mode of considering annuities is perhaps the simplest and easiest to be comprehended by a person unacquainted with algebra, &c.

As the principal is to the amount, so is 100,000*l.* to the tabular amount, which found in the table against the time will be under the rate.

EXAMPLES.

(11) At what rate of compound interest will 240*l.* amount to 277*l.* 16*s.* $7\frac{1}{4}$*d.* in three years?

(12) At what rate of compound interest will 146*l.* 10*s.* gain 31*l.* 15*s.* 6*d.* in five years?

Annuities, pensions, leases in reversion, &c. &c. may be reckoned as compound interest; for if a sum be lent, the yearly interest of which is equal to the annuity, then the amount of the interest of that sum for any given time is the amount of the annuity for that time; wherefore as the rate *per cent* is to 100*l.* so is any yearly annuity to a principal, the interest whereof will be equal to that annuity; then the compound interest of that principal will be the amount of that annuity; the present worth of which is found as in the second case in compound interest.

EXAMPLES.

(13) What will an annuity of 45*l.* *per annum* amount to in nine years, at 5*l.* *per cent per annum*, compound interest?

(14) What is the present worth of an annuity of 20*l.* *per annum* to continue eight years, allowing compound interest at 5*l.* *per cent per annum?*

(15) A person gave 400*l.* for an annuity of 50*l.* *per annum*, to continue ten years, whether did he gain or lose by the purchase, and how much, reckoning compound interest at 5*l.* *per cent per annum?*

(16) What must I give for an estate which is worth 50*l.* *per year*, but which is subject to an annuity of 30*l.* a year, for twelve years to come, so that I may have 4*l.* *per cent per annum* for my money?

PROMISCUOUS QUESTIONS,

Relating to Simple and Compound Interest, Annuities, &c.

(17) Whether will 256*l.* gain more in 14 years at 6*l.* *per cent* simple interest, or at 5*l.* *per cent* compound interest, and how much?

(18) An estate of 50*l.* *per year* is to be purchased for 12 years, how much is it worth, allowing compound interest at $4\frac{1}{4}$*l.* *per cent?*

(19) A person has an estate of 30*l.* *per year* for 65 years, which he would exchange for another of the same value to con-

tinue for ever, what is the balance to be paid, allowing compound interest at 5*l. per cent?*

(20) What will be the amount of 320*l.* in 37 years, at 5*l. per cent per annum*, compound interest?

(21) A person having a mortgage of 400*l.* on an estate of 30*l. per annum*, in what time will it redeem itself, allowing compound interest at 5*l. per cent per annum?*

EXCHANGE.

EXCHANGE among merchants and bankers is a trade in money, carried on between one place and another, by means of bills of exchange.

The rule of exchange is an easy application of the rule of three.—For as any piece or quantity of foreign money is to its value in sterling money, so is any other quantity of the like foreign money to its value in sterling money.—And on the contrary, as any sterling money is to its value in foreign money, so is any other quantity of sterling money to its value in the like foreign money. (*a*)

After the revolution in France, the national convention made a decree, that the livres, sols, and deniers, should be changed into francs and centimes, which are calculated according to the following table.

10 centimes make 1 decime.
10 decimes or 100 centimes make 1 franc.

In the question of exchange on France, the livres, sols, &c., must be reduced into francs and centimes, which may be performed with a sufficient degree of accuracy by stating thus:—81*liv.* : 80*fr.* :: the number of livres, sols, &c.; the number of francs and centimes.

Exchange with Britain is at a variable number of francs and cents for 1*l.* One franc is equal to 10*d.* English, nearly. Par of exchange is 24*fr.* 73*c.*

(*a*) PAR OF EXCHANGE is the constant and certain value of foreign money compared with sterling, *i. e.* English money.

COURSE OF EXCHANGE is the fluctuating value of foreign money compared with sterling, and is sometimes above and sometimes below PAR.

The word AGIO expresses the difference between bank money and current money, or cash. For if a merchant sell a quantity of goods, and agree to take as payment either 100 livres bank money, or 105 current money or cash, in such case, the AGIO is 5*l. per cent.* Hence we see, that foreign bank money is finer, that is, of more value, than their currency.

TABLE.*

HOLLAND.

		s.	*d.*	
8 pennings	1 grote or penny..		$\frac{1}{20}$	
2 grotes or 16 pen.	1 stiver	0 .	1	par of exchange.
20 stivers	1 florin or guilder	1 .	9	1*l.* sterling is
$2\frac{1}{2}$ guilders	1 rix dollar.....	4 .	6	equal to 36*s.*
6 guilders	1 pound Flemish..	10 .	6	7*d.* Flem.

HAMBURGH.

		s.	*d.*	
8 pennings.....	1 grote or penny.			
12 pennings,grotes, or deniers	1 lubbish shilling..	0 .	1	par of exchange.
16 lubbish shillings	1 mark	1 .	6	1*l.* ster. is equal to
3 marks	1 rix dollar	4 .	6	35*s.* $6\frac{3}{4}$*d.* Flem.
120 lubbish shillings	1 pound Flem.....	11 .	3	

FRANCE.

		l.	*s.*	*d.*	
12 deniers.....	1 sol or sou....	0 .	0 .	$0\frac{1}{2}$	par of exchange.
20 sols	1 livre.....	0 .	0 .	10	1 écu is equal to
3 livres	1 écu or crown..	0 .	2 .	6	2*s.* $5\frac{1}{2}$*d.* or 2*s.*
24 livres	1 louis d'or....	1 .	0 .	0	6*d.* sterling.

ITALY.

12 deniers or denarii..	1 soldi..	par of exch. at Rome.
20 sols or soldi	1 livre or lire..	The crown stamped, is equal to 6*s.* sterling.

At some places they exchange by the piastre, pezzo, or piece of $\frac{8}{8}$.

At Genoa, 5 livres 1 piece of $\frac{8}{8}$.—Par of exchange, piastre equal to 4*s.* 2*d.*

At Leghorn, 6 livres 1 piece of $\frac{8}{8}$.—Par of exchange the same as at Genoa.

At one bank in Venice, 6 soldi 1 gross; and 24 grosses, 1 ducat.

Par of exchange, ducat equal to 4*s.* 4*d.* sterling.

SPAIN.

		s.	*d.*	
34 marvadise..	1 rial.....	0 .	5	par of exchange.
8 rials	1 piastre	3 .	7	piastre equal to 3*s.* 7*d.*
10 rials	1 dollar.....	4 .	6	sterling.

N.B. The above coins are used at Madrid, Seville, and Cadiz; in other towns they are somewhat different.

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* For a complete list of tables for exchange, see Guthrie's Geography.

PORTUGAL.

		s.	*d.*
1000 reas.....	1 milrea	5 .	$7\frac{1}{2}$
400 reas.....	1 crusade....	2 .	3

N.B. The following Portugal coins were formerly current in England; viz. moidore, 27*s.*; joanese, 36*s.*; double john, 3*l.* 12*s.*; and their subdivisions.

EXAMPLES.

(1) London remits to Dublin 375*l.* 15*s.* sterling; for how much will it pay in Dublin, exchange being 10*l. per cent?* (*b*)

(2) London remits to America, or the West Indies, 327*l.*; for how much will it pay there, exchange being 45*l. per cent?* (*c*)

(3) How much Flemish will 468*l.* sterling amount to, exchange 34*s.* Flemish per pound sterling? (*d*)

(*b*) Accounts are kept in Ireland, in the same way as in Great Britain. The exchange is always in favour of England, unless mentioned to the contrary. An English shilling will pay for 13*d.* in Dublin, and an English guinea for 22*s.* 9*d.*

EXAMPLE.—In 347*l.* 10*s.* English, how much Irish, exchange $8\frac{1}{2}$*l. per cent?* Here 100*l.* of English money will pay for 108*l.* 10*s.* in Ireland; wherefore, by the Rule of Three, say, as 100*l.* Eng. : 108*l.* 10*s.* Irish :: 347*l.* 10*s.* Eng. : 377*l.* 0*s.* 9*d.* Irish. On the contrary: in 377*l.* 0*s.* 9*d.* Irish, how much English, exchange $8\frac{1}{2}$*l. per cent?*

As $108\frac{1}{2}$*l.* Irish : 100*l.* Eng. :: 377*l.* 0*s.* 9*d.* Irish : 347*l.* 10*s.* English.

Whether we say the exchange is 8*l. per cent* or 10*l. per cent*, it is understood that 100*l.* English is worth 108*l.* or 110*l.* when sent to Ireland.

(*c*) America and the West Indies keep their accounts as in England, and their money is called *currency*. Scarcity of CASH obliges them to substitute a *paper currency*, and the course of exchange varies in proportion to the scarcity of *cash*.

EXAMPLE.—In 346*l.* 10*s.* of the money of America, or the West Indies, how much English, exchange 40*l. per cent?*

As 140*l.* : 100*l.* :: 346*l.* 10*s.* : 247*l.* 10*s.* English.

(*d*) Holland, Flanders, and Germany, sometimes keep their accounts as in England, but more commonly as in the tables. The questions under these heads will be easily performed, if the necessary attention be paid to the tables.

EXAMPLE.—In 346*l.* Flemish, how much sterling, exchange 35*s.* Flemish per £ sterling?

As 35*s.* : 1*l.* :: 346*l.* : 197*l.* 14*s.* $3\frac{1}{4}$*d.* sterling.

How many Flemish guilders must be paid for 39*l.* 15*s.* 4*d.* sterling, exchange 35*s.* 6*d.* Flemish *per* £ sterling?

First, as 1*l.* : 35*s.* 6*d.* :: 39*l.* 15*s.* 4*d.* : 16940 pence, this multiplied by 8, because 8 pennings are a grote or penny, gives $16940 \times 8 = 135520$ pen., which, divided by 16 and 20, gives 423 guilders, 10 stivers.

In 354 guilders, 15 stivers, how much sterling, exchange 34*s.* 6*d.* *per* £ sterling?

[As

(4) How many French livres, as also francs and centimes, must be received for 127*l.* 18*s.* 6*d.* sterling, exchange $52\frac{7}{8}d.$ *per écu?* (*e*)

(5) A merchant at Madrid remits to London 849 pieces of eight at $58\frac{1}{2}d.$ *per piece*, how much sterling is the sum?

(6) How many Venice ducats will a draft for 213*l.* 10*s.* sterling amount to, exchange at 49*d.* *per ducat?*

(7) Dublin remits to London 276*l.* 10*s.* Irish, what sum sterling is it equal to, exchange 108*l.* for 100*l.*?

(8) To how much sterling will 1982 livres 10 sols French amount, exchange 51*d.* *per écu?*

(9) Spain draws upon London for 1224 piastres, exchange $50\frac{5}{8}d.$ per piastre, how much sterling will it be?

(10) Leghorn draws upon London for 1500 livres, how much sterling will satisfy this draft, exchange $50\frac{1}{2}d.$ sterling *per piastre*, or piece of $\frac{8}{8}$?

(11) Jamaica remits to England a bill of 1297*l.*, what sum is it equal to here, exchange 38*l.* *per cent?*

(12) A gentleman travelling, would exchange 121*l.* 9*s.* 2*d.* sterling for Venice ducats, at 4*s.* 5*d.* each, how many will he receive?

(13) How many crowns, and how many francs and cents, must be paid in Paris, to receive 392*l.* 8*s.* in London, exchange $54\frac{1}{2}d.$ *per crown?*

(14) Venice draws upon London for 1045 ducats, 22 grosses, exchange at 49*d.* sterling *per ducat*, how much English money will discharge the bill?

(15) How much sterling money will be received in England for 1279*l.* 14*s.* paid in Maryland, exchange 32*l.* *per cent?*

(16) How many French crowns may I have for 205*l.* 7*s.* 11*d.* sterling, exchange at $51\frac{3}{8}d.$ *per écu*, and what will be their amount in francs and cents?

(17) A merchant at Portugal remits to London 2750 milreas, exchange at 6*s.* 5*d.* *per milrea*, how much sterling will he be credited for in London?

(18) How much sterling money must be paid in London to receive 7938 francs 40 cents at Paris, exchange 10*d.* *per franc?*

As 34*s.* 6*d.* : 1*l.* :: 354 guilders, 15 stivers : 34*l.* 5*s.* 6*d.* sterling. Reduce the first and third terms to Flemish pence, and the stating will be,—

As 414*pen.* : 1*l.* :: 14190*pen.* : 34*l.* 5*s.* 6*d.* sterling.

In 160 bank guilders, how much currency agio $5\frac{5}{8}$ *per cent*, or 5 guilders, 12 stivers, 8 pennings, *per cent?*

As 100*b. g.* : 105*cur. g.* 12*stiv.* 8*pen.* :: 160*b. g.* : 169*cur. g.*

(*e*) The exchange with France, Spain, &c., is so very easy, that it is not conceived necessary to give any illustration of the questions.

(19) How many livres must be given at Genoa for 175*l.* 15*s.* sterling, 52*d.* sterling per piastre, or piece of $\frac{8}{8}$?

(20) How many milreas will 357*l.* 1*s.* amount to, exchange at 5*s.* 8*d.* *per milrea?*

(21) To how much sterling will 10213 francs 80 cents amount, exchange at 5*d.* *per half-franc?*

(22) To how much sterling will a Portugal draft for 1261 milreas, 768 reas amount, when the exchange is 5*s.* 8*d.* *per milrea?*

(23) Bought in Newry 26 casks of Irish butter, each 3*qr.* 17*lb.* at 67*s.* 6*d.* *per cwt*, tare 13*lb.* *per cwt;* charges of shipping, $1\frac{1}{4}$*l.* *per cent;* how much must I remit, exchange at $12\frac{3}{4}$*l.* *per cent?*

(24) Sold to a merchant at New York, 17 pieces of gingham, each $47\frac{1}{4}$*yds.* at $22\frac{1}{4}$*d.* per yard; 41 pieces of thickset, each $43\frac{3}{4}$*yds.* at 2*s.* 7*d.;* 37 pieces of woollen cloth, each $32\frac{1}{2}$*yds.* at 6*s.* 9*d.*, charges of shipping $1\frac{3}{4}$*l.* *per cent;* insurance $12\frac{3}{4}$*l.* *per cent;* how many dollars, at 4*s.* 8*d.* each currency, must he remit, exchange 43*l.* *per cent?*

(25) How much sterling will 749*l.* 16*s.* Flemish amount to, at 34*s.* Flemish *per £ sterling?*

(26) How many Flemish guilders may I have for 347*l.* 8*s.* 4*d.* sterling, exchange at 35*s.* $3\frac{1}{2}$*d.* *per £ sterling?*

(27) How much sterling must a person receive in England, for 10542 francs?

(28) A person going to France, takes with him 250 sovereigns; how many francs will he receive for them?

(29) Required the arrears of a sum of 2000 livres, from the 1*st* of January, 1837, to the 6*th* of January, 1835, in francs and centimes; and how much sterling must be received, exchange 25*fr.* for 20*s.* sterling?

(30) To how much will 1080 livres amount, in francs and cents, from the 1*st* of January, 1819, to the 22*nd* of March, 1844; and how much English money will be equivalent to it, exchange 24*fr.* 63*c.*?

(31) What will be the arrears of a perpetual rent of 4200 livres, from the 1*st* of January, 1838, to the 23*rd* of September, 1845, in francs and cents?

(32) What will be the amount, in francs and cents, of the arrears of three annuities, making together 11610 livres, from the 1*st* of July, 1820, to the 22*nd* of March, 1844; and in sterling money, exchange 23*fr.* 25*c.*?

(33) A person makes a claim for an annuity of 4800 livres on the 3*rd* of June, 1846, which had been forfeited on the 1*st* of July, 1824; what will be the amount he has to receive in the present French money?

(34) A person leaving France on the 1*st* of July, 1824, forfeits an annuity of 9600 livres; what will he have to receive

in francs and cents, and in English money, exchange $10\frac{3}{8}d.$ *per franc*, if his claims be allowed on the 2*nd* of March, 1843?

SINGLE FELLOWSHIP.

Single Fellowship teaches to proportion gain or loss among the several partners or sharers thereof, according to their stocks or interests therein, without any regard to time.

RULE.

As the total sum of the stocks is to the total gain or loss, so is each man's particular stock to its particular gain or loss.

EXAMPLES.

(1) Three men, A, B, and C, make a venture; A advances 30*l.*, B 40*l.*, and C 50*l.*; they had a return worth 180*l.*; what is each man's share thereof?

(2) Three men, A, B, and C, put in money together; A put in 25*l.*, B 30*l.*, and C 45*l.*; they gained 33*l.* 6*s.* 8*d.*; what are their respective shares?

(3) Three men, A, B, and C, freight a ship with wine; A loaded 110 tons, B 97 tons, and C 133 tons; in a storm 85 tons were thrown overboard; how much must each sustain of the loss?

(4) 46 acres, 3 roods, and 35 perches of land, is to be divided among four men, A, B, C, and D, in proportion to their

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(1) Three men, A, B, and C, trade together; A advances 8*l.*, B 12*l.*, and C 16*l.*, they gain 18*l.*; what is each man's share?

(2) Divide 152*l.* into 3 parts, which shall be to one another as 3, 7, and 9.

1—A 8
B 12
C 16
—
36 : 18 { :: 8 : 4 A
:: 12 : 6 B
:: 16 : 8 C
—
Proof 18
—

2—3
7
9
—
19 : 152 { :: 3 : 24
:: 7 : 56
:: 9 : 72
—
Proof 152
—

By this rule a bankrupt's estate is divided among his creditors; also lands are divided among the proprietors, &c.

If the second term be divided by the first, the quotient will be a common multiplier, by which you may multiply each third term for the answer.

Or, if you can divide the first and second terms by one and the same number without a remainder, you may put the quotients for those terms respectively, which will sometimes shorten the operation.

estates; now A's estate is valued at 80*l.*, B's at 120*l.*, C's at 200*l.*, and D's at 300*l.* *per annum*, what quantity of land must each have?

(5) Two men, A and B company; A put in 20*l.*, B put in 144 ducats; they gained 67*l.* 10*s.*, of which A's share was 30*l.*; what was the value of a ducat?

(6) A bankrupt owes to 6 persons, A, B, C, D, E, and F, the following sums, viz. to A 140*l.*, to B 180*l.*, to C 320*l.* 10*s.*, to D 280*l.*, to E 674*l.* 10*s.*, and to F 1000*l.*; his whole estate is found to be worth no more than 1946*l.* 5*s.*; what must each creditor receive, and what does he pay in the pound?

(7) Four men, A, B, C, and D, trade in partnership together; A put in 240*l.*, B 360*l.*, C 420*l.*, and D 500*l.*; upon settling accounts at the year's end, they found they had gained 456*l.*; what is each man's share of the gain?

(8) Divide 1628*l.* into four shares, which shall be to one another as 4, 5, 6, and 7.

(9) Three men trade together; A put in 420*l.*, B 36*l.* more than A, and C a third part of both A's and B's stock; they gained 15*l.* *per cent* upon the whole stock; how much must each have?

(10) A and B trade together; A's capital is 850*l.*, B's is only 400*l.*, but he reckons his services worth 120*l.* *per annum*; they gain 315*l.* 15*s.* 6*d.*; how much does each gain?

(11) T. H. had 68 bags of cotton, weighing 205*cwt.* 2*qr.* 5*lb.* gross, tare $1\frac{1}{2}$*lb.* in 80*lb.* at $17\frac{1}{4}$*d.* *per pound*; C. W. had 15*hhds.* of tobacco, each 6*cwt.* 3*qr.* 5*lb.* gross, tare $59\frac{1}{2}$*lb.* *per hhd.* at 9 guineas *per cwt.*; S. T. 155 pieces of muslin, each $12\frac{3}{4}$*yds.* at 3*s.* 6*d.*; they sold the above articles in partnership, and gained $15\frac{1}{2}$*l.* *per cent* by them; how much must each have of the gain?

DOUBLE FELLOWSHIP.

Double Fellowship, or fellowship with time, is when the gain or loss is proportioned to both the money or stock in trade, and the time it is employed therein.

RULE.

Multiply each man's stock by the time; add those several products together; then say as the sum of those products is to the total gain or loss, so is each particular product to each man's particular gain or loss.

EXAMPLES.

(1) A and B trade together; A had 60*l.* in the business 12

months, B 70*l.* in 9 months, and they gained 54*l.*; what is each man's share of the gain?

(2) Three men, A, B, and C, trade together; A put in 85*l.*, B 110*l.*, and C 145*l.*; but A's money was in company 12 months, B's 9 months, and C's 6 months; they gained 96*l.*; what is each man's share of the gain?

(3) A began business with a stock of 240*l.*, which not being sufficient to answer his intended purpose, at the end of 4 months he admitted B and C into partnership, when B advanced 360*l.* and C 480*l.*; at the year's end, upon settling accounts, they found there was a gain of 108*l.*; what is each man's share thereof?

(4) A, B, and C, trade together with joint stocks for 12 months; A has 500*l.*, B 300*l.*, and C 210*l.*; now at the end of 5 months, A took out of his, 250*l.*; at 6 months, B added to his, 400*l.*; and C added to his, 150*l.* at the end of 2 months; at 5 months, C took out 150*l.*; at 10 months, B put in 100*l.*, and at 7 months, A put in 300*l.*; A took out 100*l.* at 10 months; and at 8 months, C put in 440*l.*; they gained 750*l.*; how much must each have?

Three men, A, B, and C, trade together; A had 30*l.* in company 12 months, B had 50*l.* in 9 months, and C had 80*l.* in company 6 months; they gained 32*l.* 5*s.*; what is each man's share thereof?

A 30 × 12=360
B 50 × 9=450
C 80 × 6=480

	£	*s.*			£	*s.*	
1290	32	5	::	360	9	0	A
			::	450	11	5	B
			::	480	12	0	C

Proof £32 . 5

The gain of different sums for different times, should be proportioned to the interests of those sums for the respective times; and the interest of two different sums for different times will be to one another, as the products of those sums by their respective times: hence the rule.

The gain, or loss only, is to be divided by this rule; for if both stock and gain were divided by this proportion, there would arise a very great error, as will appear by the following example.

A and B trade together; A had 20*l.* in company 12 months, B 200*l.* but 1 month, the amount of their stock then was 264*l.*; what was each man's share thereof?

20 × 12=240; 200 × 1=200, and 240+200=440, then as 440 : 264 :: 240 : 144 A's share, and 440 : 264 :: 200 : 120 B's share; by which it appears, that A gained 124*l.* and B lost 80*l.*; whereas the gain 44*l.* being divided by the rule, A's share thereof will be 24*l.* and B's 20*l.*, which added to their respective stocks, A's share of the amount will be 44*l.* and B's 220*l.*, hence it appears necessary to take care to divide the gain only, and not the stock by double fellowship.

(5) Four persons, A, B, C, and D, enter into partnership, each advancing 300*l.*; at the end of 2 months, B took out 120*l.*, and A put in 150*l.*; at the end of 5 months, A took out 200*l.*, and B put in the same sum at the end of 6 months, and 50*l.* more at the end of 9 months; at the end of 9 months, A also put in 150*l.*; C put in 180*l.* at the end of 4 months, took out 220*l.* at the end of 9 months, and put in 60 at the end of 10 months; D put in 100*l.* at the end of 7 months, and 50*l.* more at the end of 9 months; at the year's end they had gained 333*l.*; what is each man's share thereof?

(6) Four persons, A, B, C, and D, take a quantity of grazing ground for 103*l.* 6*s.*; A put therein 24 oxen 21 weeks; B 32 oxen 16 weeks; C 18 oxen 25 weeks; and D 40 oxen 15 weeks; what must each person pay, and how much *per ox per week?*

(7) A ship's company take a prize, valued at 8460*l.* half of which the owners take, and the rest is to be divided among the ship's company in proportion to their pay and time they have been on board; the captain's pay was 5*l.* per month, and he had been on board 12 months; two mates 4*l.* per month, 11 months each; three lieutenants, each 10 months, at 3*l.* 15*s.* per month; 140 sailors, each 9 months, at 3*l.* per month; what is each man's share?

(8) J. Ball began business with 500*l.*, but wishing to extend his concern, at the end of 4 months he took W. Holt into partnership, with a capital of 750*l.*; at the year's end their whole stock amounted to 2000*l.*; how much did each gain?

INVOICES, OR BILLS OF PARCELS.

Rochdale, November 7, 1846.

MR. PHILIP HARGREAVES,

Bought of JESSE HALL.

(1) 6 pieces of flannel, each 29 yards, at 15*d. per yard.*
6 pieces do. each 33 yards, at 16½*d. per yard.*
4 pieces do. each 32 yards, at 18*d. per yard.*
6 pieces do. each 28 yards, at 19*d. per yard.*
5 pieces do. each 34 yards, at 20*d. per yard.*
9 pieces do. each 26 yards, at 21½*d. per yard.*
3 pieces do. each 28 yards, at 23*d. per yard.*
Pack-sheets, 11*s.* 3*d.*, cord 18*d.*, packing 9*d.*
Three months' credit.

3*rd Nov.* 1846, SOLD—

(2) 6 pieces of Irish linen, each 25 yards, at 15*d. per yard;* 6

pieces do. each 26*yds.* at 16*d*; 6 pieces do. each 25*yds.* at 16½*d*; 7 pieces do. each 26*yds.* at 17½*d*; 19 pieces do. each 27*yds.* at 19*d*; 6 pieces do. each 27*yds.* at 9½*d*; 8 pieces do. each 26*yds.* at 21*d*; 9 pieces do. each 26*yds.* at 21½*d*; 6 pieces do. each 26*yds.* at 23*d.*

Wrappering 10*s.* 6*d*, cord and package 2*s.* 9*d.*

Four months' credit.

5*th Nov.* 1846, SOLD—

(3) 5 *doz.* pairs of worsted stockings, at 16*s. per doz.*; 7 *doz. do.* at 18*s.* 9*d*; 9 *doz. do.* at 22*s.* 6*d*; 12 *doz. do.* at 38*s.* 6*d*; 6 *doz. do.* at 42*s.* 6*d*; 7 *doz. do.* silk, at 56*s*; 8 *doz. do.* at 61*s*; 3 *doz. do.* at 65*s.*

Six months' credit.

7*th Nov.* 1846, SOLD—

(4) 6 pieces of grey calico, each 28 yards, at 10*d*; 10 pieces, each 28*yds.* at 10¼*d*; 12 pieces, each 31*yds.* at 11*d*; 20 pieces, each 28*yds.* at 11¼*d*; 31 pieces, each 28*yds.* at 11½*d*; 32 pieces, each 28*yds.* at 13*d*; 40 pieces, each 28*yds.* at 13¼*d*; 48 pieces, each 28*yds.* at 13½*d.*

Twelve months' credit.

23*rd Nov.* 1846, SOLD—

(5) 61 pieces of coarse cottons, each 32*yds.* at 10½*d*; 40 pieces, each 33*yds.* at 11*d*; 46 pieces fine do. each 30*yds.* at 13½*d*; 50 pieces fine calico, each 28*yds.* at 12¼*d*; 60 pieces do. bleached, each 28*yds.* at 13½*d*; 20 pieces, each 28*yds.* at 15*d.*

Twelve months' credit.

25*th Nov.* 1846, SOLD—

(6) 6 pieces of printed calico, each 28*yds.* at 18½*d*; 7 pieces, each 28*yds.* at 19½*d*; 25 pieces, each 28*yds.* at 20*d*; 36 pieces, each 28*yds.* at 31*d*; 5 pieces, each 28*yds.* at 22*d*; 10 pieces, each 28*yds.* at 22½*d*; 12 pieces, each 28*yds.* at 23*d.*

Discount 2½ *per cent.*

Three months' credit.

25*th Nov.* 1846, SOLD—

(7) 4 pieces of printed linen, each 29¼*yds.* at 14½*d*; 6 pieces, each 30*yds.* at 14¾*d*; 5 pieces, each 27*yds.* at 15*d*; 7 pieces, each 30½*yds.* at 16*d*; 9 pieces of printed calico, each 28*yds.* at 17½*d*; 8 pieces, each 28*yds.* at 19*d*; 12 pieces, each 28*yds.* at 20*d*; 15 pieces, each 28*yds.* at 21½*d.*

Discount 5*l. per cent.*

Four months' credit.

5*th Dec.* 1846, SOLD—

(8) 6 pieces of nankeen, each 25*yds.* at 15*d. per yd;* 8 pieces, each 25*yds.* at 15½*d;* 9 pieces, each 25½*yds.* at 16½*d;* 10 pieces, each 27*yds.* at 17*d;* 7 pieces, each 26*yds.* at 17½*d;* 9 pieces, each 26*yds.* at 18½*d;* 13 pieces, each 26½*yds.* at 19*d;* 11 pieces, each 27*yds.* at 20½*d.*

Deduct 2½*l. per cent,* and pay present bill.

8*th Dec.* 1846, SOLD—

(9) 5 pieces of muslin, each 12½*yds.* at 23½*d;* 6 pieces, each 11¾*yds.* at 2*s.* 1*d;* 9 pieces, each 10¾*yds.* at 2*s.* 2*d;* 10 pieces, each 12*yds.* at 2*s.* 2½*d;* 12 pieces, each 13*yds.* at 2*s.* 3*d;* 8 pieces, each 11*yds.* at 2*s.* 4*d;* 15 pieces, each 11½*yds.* at 2*s.* 5*d;* 17 pieces, each 11¾*yds.* at 2*s.* 7*d.*

Discount 3¼*l. per cent.*

Two months' credit.

12*th Dec.* 1846, SOLD—

(10) 10 pieces of pillow fustian, each 26*yds.* at 10*d;* 12 pieces, each 27*yds.* at 10½*d;* 11 pieces, each 26½*yds.* at 11½*d;* 10 pieces, each 28*yds.* at 12½*d;* 17 pieces, each 27*yds.* at 13*d;* 16 pieces, each 26*yds.* at 14*d;* 15 pieces, each 25*yds.* at 14*d;* 16 pieces, each 26½*yds.* at 15*d;* 18 pieces, each 27*yds.* at 16½*d.*

Six months' credit.

19*th Dec.* 1846, SOLD—

(11) 3 pieces of woollen cloth, each 29*yds.* at 3*s.* 1*d. per yard;* 4 pieces, each 29*yds.* at 3*s.* 4*d;* 5 pieces, each 30*yds.* at 3*s.* 5*d;* 5 pieces, each 30*yds.* at 3*s.* 8*d;* 6 pieces, each 28*yds.* at 3*s.* 8*d;* 8 pieces, each 29*yds.* at 3*s.* 9*d;* 10 pieces, each 30*yds.* at 3*s.* 9*d;* 14 pieces, each 32*yds.* at 3*s.* 11*d.*

Discount 6*l. per cent.*

Four months' credit.

26*th Dec.* 1846, SOLD—

(12) 8 pieces of woollen cloth, each 28¼*yds.* at 2*s.* 4*d;* 6 pieces, each 28*yds.* at 2*s.* 1*d;* 6 pieces, each 28*yds.* at 2*s.* 3*d;* 8 pieces, each 29*yds.* at 2*s.* 4*d;* 9 pieces, each 29*yds.* at 2*s.* 5*d;* 10 pieces, each 30*yds.* at 2*s.* 5*d;* 12 pieces, each 30*yds.* at 2*s.* 6*d;* 15 pieces, each 31*yds.* at 2*s.* 7*d;* 16 pieces, each 31*yds.* at 2*s.* 8*d;* 19 pieces, each 31*yds.* at 2*s.* 9*d;* 5 pieces, each 27*yds.* at 23*d;* 8 pieces, each 28*yds.* at 23*d;* 11 pieces, each 29*yds.* at 2*s.* 2*d;* 12 pieces, each 29*yds.* at 2*s.* 3*d;* 13 pieces, each 29*yds.* at 2*s.* 4*d;* 15 pieces, each 30*yds.* at 2*s.* 4*d;* 15 pieces, each

30*yds.* at 2*s.* 7*d*; 20 pieces, each 31*yds.* at 2*s.* 7*d*; 25 pieces, each 32*yds.* at 2*s.* 8*d*; 30 pieces, each 30*yds.* at 2*s.* 11*d.*

Discount $2\frac{3}{4}$*l. per cent.*

Three months' credit.

28*th Dec.* 1846, SOLD—

(13) 4 pieces of thick set, each 40*yds.* at 23*d*; 6 pieces, each $41\frac{1}{4}$*yds.* at $23\frac{1}{2}$*d*; 5 pieces, each $42\frac{1}{2}$*yds.* at 2*s*; 8 pieces, each 43*yds.* at 2*s.* 1*d*; 8 pieces, each 43*yds.* at 2*s.* $1\frac{1}{2}$*d*; 10 pieces, each 44*yds.* at 2*s.* 2*d*; 6 pieces, each 43*yds.* at 2*s.* $2\frac{1}{2}$*d*; 9 pieces, each $43\frac{1}{2}$*yds.* at 2*s.* 3*d*; 12 pieces, each 43*yds.* at 3*s*; 11 pieces, each 44*yds.* at 3*s.* 1*d.*

Discount 1*l. per cent.*

29*th Dec.* 1846, SOLD—

(14) 4 pieces of velveteen, each $42\frac{1}{2}$*yds.* at 4*s.* 1*d*; 6 pieces, each $42\frac{3}{4}$*yds.* at 4*s.* 2*d*; 8 pieces, each $42\frac{1}{2}$*yds.* at 4*s.* $2\frac{1}{2}$*d*; 6 pieces, each 44*yds.* at 4*s.* 3*d*; 9 pieces, each $44\frac{1}{4}$*yds.* at 4*s.* $4\frac{1}{2}$*d*; 11 pieces, each 44*yds.* at 4*s.* $5\frac{3}{4}$*d*; 12 pieces, each $45\frac{1}{2}$*yds.* at 4*s.* 7*d*; 13 pieces, each $43\frac{1}{4}$*yds.* at 4*s.* $8\frac{1}{2}$*d*; 14 pieces, each $42\frac{3}{4}$*yds.* at 4*s.* $9\frac{3}{4}$*d*; 15 pieces, each $42\frac{1}{2}$*yds.* at 4*s.* 11*d*; 13 pieces, each $40\frac{3}{4}$*yds.* at 5*s.* $0\frac{1}{2}$*d*; 3 pieces, each $47\frac{1}{4}$*yds.* at 5*s.* $1\frac{3}{4}$*d*; 6 pieces, each $46\frac{1}{2}$*yds.* at 5*s.* 3*d*; 18 pieces, each $48\frac{1}{4}$*yds.* at 5*s.* $3\frac{1}{2}$*d.*

1*st Jan.* 1847, SOLD—

(15) 3 pieces of muslinets, each 50*yds.* at 16*d. per yard*; 4 pieces, each $50\frac{1}{2}$*yds.* at $16\frac{1}{4}$*d*; 5 pieces, each $51\frac{1}{4}$*yds.* at 17*d*; 4 pieces, each $51\frac{3}{4}$*yds.* at $17\frac{1}{4}$*d*; 6 pieces, each $53\frac{1}{2}$*yds.* at $18\frac{1}{2}$*d*; 6 pieces, each 54*yds.* at 19*d*; 7 pieces, each $54\frac{1}{4}$*yds.* at 20*d*; 8 pieces, each $54\frac{1}{4}$*yds.* at $20\frac{1}{4}$*d*; 9 pieces, each $55\frac{3}{4}$*yds.* at 22*d*; 10 pieces, each 55*yds.* at $22\frac{1}{4}$*d*; 7 pieces, each $56\frac{1}{4}$*yds.* at 23*d*; 5 pieces, each $56\frac{1}{2}$*yds.* at $23\frac{1}{4}$*d*; 12 pieces, at 85*s. per piece*; 20 pieces, at 105*s. per piece.*

8*th Sep.* 1847, SOLD—

(16) 8*lb.* of tea, at 2*s.* 6*d. per pound*; 9*lb.* at 3*s.* $4\frac{1}{2}$*d*; $16\frac{1}{4}$*lb.* at 4*s.* $0\frac{1}{2}$*d*; $11\frac{1}{2}$*lb.* at 4*s.* $9\frac{3}{4}$*d*; $16\frac{3}{4}$*lb.* at 7*s.* 6*d*; 25*lb.* at 8*s.* 4*d*; 15*lb.* at 8*s.* $8\frac{1}{2}$*d*; $111\frac{1}{2}$*lb.* at 9*s.* 6*d*; $96\frac{3}{4}$*lb.* at 11*s.* 2*d*; $162\frac{1}{4}$*lb.* at 12*s.* $4\frac{1}{2}$*d*; $13\frac{1}{4}$*lb.* at 16*s.* 2*d*; $5\frac{3}{4}$*lb.* at 18*s.* 11*d.*

Discount $3\frac{1}{2}$*l. per cent.*

8*th Sep.* 1847, SOLD—

(17) $1\frac{1}{4}$ dozen hats, at 33*s.* 4*d. per dozen*; $3\frac{1}{2}$ dozen, at 42*s.* 6*d*

5 dozen, at 49*s.* 3*d*; 11 dozen, at 5*gs*; 13 dozen, at 119*s*; 6 hats, at 7*s.* 6*d.* each; 17 hats, at 23*s.* 6*d.*
Deduct 6*l. per cent*, discount.

11*th Jan.* 1848, BOUGHT OF—

(18) 4 pair of gloves, at $15\frac{1}{2}d$; 5 pair at $16\frac{1}{4}d$; 11 pair at $17\frac{3}{4}d$; 6 pair at $19\frac{1}{4}d$; 13 pair at $21d$; 15 pair at $23\frac{1}{2}d$; 23 pair at $23\frac{3}{4}d$; 3 dozen pair at 15*s.* 6*d. per dozen.*
Deduct $7\frac{1}{2}l$. *per cent.*

17*th Sep.* 1848, SOLD—

(19) $22\frac{1}{2}yds.$ of ribbon, at $3\frac{1}{2}d.$ *per yard*; $16\frac{1}{4}yds.$ at $3\frac{3}{4}d$; $9\frac{3}{4}yds.$ at $4\frac{1}{2}d$; $16\frac{1}{2}yds.$ at $5\frac{1}{4}d$; $12\frac{1}{2}yds.$ at $5\frac{3}{4}d$; $8\frac{3}{4}yds.$ at $6\frac{1}{4}d$; $11\frac{1}{2}yds.$ at $7\frac{1}{2}d$; $13\frac{1}{2}yds.$ at $8d$; $15\frac{3}{4}yds.$ at $9\frac{1}{4}d$; $19\frac{1}{4}yds.$ at $10\frac{1}{4}d$; $21\frac{3}{4}yds.$ at $13\frac{1}{2}d$; $27\frac{1}{4}yds.$ at $15\frac{3}{4}d$; $37\frac{1}{2}yds.$ at $19\frac{1}{4}d.$
Deduct 8*l. per cent.*

18*th Sep.* 1848, SOLD—

(20) 5*lb.* of candles, at $6\frac{1}{4}d$; $4\frac{1}{2}lb.$ at $6\frac{1}{2}d$; 7*lb.* at $7\frac{1}{2}d$; 9*lb.* at $7\frac{1}{4}d$; 12*lb.* at $7\frac{3}{4}d$; 11*lb.* of soap, at $6\frac{1}{4}d$; 13*lb.* at $7\frac{1}{4}d$; 18*lb.* at $7\frac{1}{2}d$; $23\frac{3}{4}lb.$ at $7\frac{3}{4}d$; 34*lb.* at $7\frac{1}{4}d$; $37\frac{1}{2}lb.$ at $8\frac{1}{4}d.$

18*th Sep.* 1848, SOLD—

(21) 5 shawls, at 3*s.* 4*d.* each; 6 do. at 3*s.* 8*d.* each; 8 do. at 4*s.* 2*d.* each; 19 do. at 5*s.* 3*d.* each; 1 *dozen* do. at 45*s.* 4*d. per doz*; $3\frac{1}{2}doz.$ at 6*s.* 3*d.* per shawl; 11 shawls at 7*s.* 9*d.* each; 22 do. at 9*s.* 11*d.* each; 32 do. at 9*s.* 11*d.* each; 45 do. at 10*s.* 6*d.* each; 3 do. at 12*s.* 2*d.* each; 4 do. at 13*s.* 6*d.* each; 18 do. at 15*s.* 9*d.* each; 11 do. at 16*s.* 1*d.* each.

19*th Sep.* 1848, SOLD—

(22) 21 yards of lace, at $4\frac{1}{4}d.$ *per yd*; $15\frac{3}{4}yds.$ at $5\frac{1}{2}d$; $16\frac{1}{4}yds.$ at $6\frac{3}{4}d$; $22\frac{1}{4}yds.$ at $7\frac{1}{2}d$; $33\frac{1}{2}yds.$ at $8\frac{1}{4}d$; $41\frac{1}{4}yds.$ at $10\frac{1}{2}d$; $118\frac{1}{2}yds.$ at $13\frac{1}{2}d$; 11*yds.* at 2*s.* 2*d*; $71\frac{1}{2}yds.$ at 2*s.* 9*d*; $8\frac{1}{2}yds.$ at 3*s.* 5*d*; $23\frac{3}{4}yds.$ at $17\frac{1}{4}d$; 30*yds.* at $9\frac{1}{2}d$; 37*yds.* at 5*s.* 3*d.*
Discount 5*l. per cent.*

19*th Sep.* 1848, SOLD—

(23) A set of castors at 22*s.* 6*d*; a silver tankard, 13*oz.* 5*dwts.* at 6*s.* 3*d. per oz*; a silver pint, 8*oz.* 13*dwts.* at 5*s.* 9*d. per oz*; a silver punch bowl, 23*oz.* 19*dwts.* at 6*s.* 6*d. per oz*; 4 salts, each 2*oz.* 13*dwts.* at 5*s.* 9*d. per oz*; a set of tea-spoons, 19*s.* 4*d*; 4 table spoons, each 3*oz.* 16*dwts.* at

6*s.* 5*d. per oz;* 2 sauce boats, each 11*oz.* 18*dwts.* at 6*s.* 8*d. per oz;* a silver cream pitcher, 5*oz.* 13*dwts.* at 5*s.* 1*d.*

19*th Sep.* 1848, SOLD—

(24) 2 cheeses, each $49\frac{1}{4}$*lb.* at $4\frac{3}{4}$*d. per lb;* 5 do. each $33\frac{1}{4}$*lb.* at $5\frac{1}{2}$*d;* 6 do. each $22\frac{3}{4}$*lb.* at $5\frac{1}{2}$*d;* 9 do. each $42\frac{1}{2}$*lb.* at $4\frac{3}{4}$*d;* 5*cwt.* at 39*s.* 4*d. per cwt;* 13*cwt.* at $5\frac{1}{2}$*d. per lb;* 7*cwt.* at $4\frac{3}{4}$*d. per lb.*

20*th Sep.* 1848, SOLD—

(25) 5*cwt.* 2*qr.* 9*lb.* of hops at 92*s. per cwt;* 2*cwt.* 1*qr.* 9*lb.* do. at 99*s. per cwt;* 3*cwt.* 3*qr.* 27*lb.* at 101*s;* 5*cwt.* 1*qr.* 19*lb.* at 15*d. per lb;* 1*cwt.* 2*qr.* 12*lb.* at $17\frac{1}{2}$*d. per lb;* $56\frac{3}{4}$*lb.* at 57*s.* 6*d. per cwt;* 7*cwt.* 3*qr.* 21*lb.* at 121*s. per cwt;* 1*cwt.* 3*qr.* 27*lb.* at 23*d. per lb;* $72\frac{1}{4}$*lb.* at 6*l.* 5*s. per cwt.*

25*th June,* 1849, SOLD—

(26) 3 pieces of worsted florentine, each 28*yds.* at 2*s.* 3*d. per yd;* 5 pieces, each $27\frac{1}{4}$*yds.* at 2*s.* 5*d;* 13 pieces, each 28*yds.* at 3*s.* 9*d;* 12 pieces, each $29\frac{1}{2}$*yds.* at 3*s.* 11*d;* 35 pieces, each $26\frac{3}{4}$*yds.* at 4*s.* 1*d;* 42 pieces, each $29\frac{1}{4}$*yds.* at 4*s.* 5*d;* 15 pieces, each $28\frac{1}{2}$*yds.* at 4*s.* 8*d. per yard.*

Discount $1\frac{1}{2}$*l. per cent.*

2*nd July,* 1849, SOLD—

(27) $\frac{3}{4}$ yard of cloth, at 5*s.* 6*d. per yard;* $3\frac{1}{4}$*yds.* at 6*s.* 3*d;* $4\frac{5}{8}$*yds.* at 9*s.* 6*d;* $6\frac{7}{8}$*yds.* at 9*s.* 9*d;* $11\frac{4}{5}$*yds.* at 13*s.* 6*d;* $13\frac{3}{8}$*yds.* at 19*s.* 7*d;* $7\frac{2}{3}$*yds.* at 21*s;* $5\frac{1}{6}$*yds.* at 22*s.* 3*d;* $16\frac{1}{8}$*yds.* at 22*s.* 9*d;* $11\frac{1}{7}$*yds.* at 24*s.*

2*nd July,* 1849, SOLD—

(28) 1 bag of Surinam cotton, 3*cwt.* 1*qr.* 16*lb.* at $21\frac{1}{4}$*d. per lb;* 3 bags, No. I., 2*cwt.* 2*qr.* 15*lb;* No. II., 3*cwt.* 3*qr.* 27*lb;* No. III., 1*cwt.* 3*qr.* 25*lb.* at $22\frac{1}{4}$*d. per lb.* 4 bags St. Domingo do. No. I., 3*cwt.* 2*qr.* 13*lb;* No. II., 3*cwt.* 0*qr.* 10*lb;* No. III., 2*cwt.* 1*qr.* 5*lb;* No. IV., 1*cwt.* 1*qr.* 2*lb.* at $14\frac{3}{4}$*d. per lb.*

Discount 1*l. per cent.*

3*rd July,* 1849, SOLD—

(29) $3\frac{3}{8}$*yds.* of cloth, at 5*s.* 4*d. per yard;* $17\frac{1}{7}$*yds.* at 5*s.* 10*d. per yd;* $5\frac{2}{3}$*yds.* at 6*s.* 3*d;* $7\frac{3}{8}$*yds.* at 6*s.* 9*d;* $19\frac{7}{8}$*yds.* at 7*s.* 1*d;* $22\frac{1}{3}$*yds.* at 7*s.* 6*d;* $31\frac{1}{8}$*yds.* at 8*s.* 2*d;* $33\frac{1}{6}$*yds.* at 8*s.* 7*d.*

3*rd July,* 1849, SOLD—

(30) 4 bags of Barbadoes cotton; No. I., 2*cwt.* 1*qr.* 15*lb.* at

14*d. per lb;* No. II., 3*cwt.* 2*qr.* 19*lb.* at 14¼*d;* No. III., 3*cwt.* 1*qr.* 22*lb.* at 14¾*d;* No. IV., 1*cwt.* 3*qr.* 27*lb.* at 15½*d. per lb.*

7th July, 1849, BOUGHT OF—

(31) 5 bags of Grenada cotton; No. XXXII., 4*cwt.* 2*qr.* 3*lb.* at 13*d. per lb;* No. XXI., 2*cwt.* 3*qr.* 17*lb.* at 13¼*d. per lb;* No. XXVII., 3*cwt.* 1*qr.* 16*lb.* at 13½*d;* No. XLV., 2*cwt.* 1*qr.* 19*lb.* at 14¾*d;* No. XXXV., 3*cwt.* 2*qr.* 5*lb.* at 15¾*d.*
3 bags of Jamaica cotton, No. V., 2*cwt.* 1*qr.* 23*lb;* No. VII., 2*cwt.* 3*qr.* 18*lb.* at 12¼*d;* No. IX., 4*cwt.* 1*qr.* 15*lb.* at 13½*d. per lb.*

9*th July*, 1849, SOLD—

(32) 6 bags of Pernambucco cotton as under; No. IV., 2*cwt.* 1*qr.* 3*lb;* No. V., 2*cwt.* 2*qr.* 2*lb;* No. VI., 3*cwt.* 2*qr.* 15*lb;* No. VII., 2*cwt.* 3*qr.* 25*lb;* No. VIII., 1*cwt.* 2*qr.* 27*lb;* No. IX., 3*cwt.* 3*qr.* 16*lb.* at 21½*d. per pound.*
3 bags of Maranham do. No. III., 2*cwt.* 2*qr.* 13*lb;* No. IV., 2*cwt.* 1*qr.* 11*lb;* No. VI., 4*cwt.* 1*qr.* 5*lb.* at 20¼*d. per pound.*

10*th July*, 1849, SOLD—

(33) 4 casks of madder; No. XXXI., 6*cwt.* 2*qr.* 21*lb.* at 72*s.* 6*d. per cwt;* No. XXXII., 7*cwt.* 1*qr.* 13*lb.* at 79*s.* 4*d. per cwt;* No. XXXIII., 5*cwt.* 2*qr.* 17*lb.* at 84*s.* 2*d. per cwt;* No. XXXIV., 6*cwt.* 1*qr.* 25*lb.* at 102*s.* 6*d. per cwt.*
3 casks, No. XXI., 5*cwt.* 2*qr.* 17*lb.* at 75*s.* 3*d. per cwt;* No. XXIV., 8*cwt.* 0*qr.* 22*lb.* at 63*s.* 1*d. per cwt;* No. XXV., 5*cwt.* 1*qr.* 3*lb.* at 96*s.* 2*d. per cwt.*
Tare 13*lb. per cwt.*

10*th July*, 1849, SOLD—

(34) 6 casks of Russian ashes; No. I., 4*cwt.* 2*qr.* 15*lb;* No. II., 7*cwt.* 3*qr.* 5*lb;* No. III., 6*cwt.* 1*qr.* 19*lb;* No. IV., 7*cwt.* 0*qr.* 2*lb;* No. V., 5*cwt.* 2*qr.* 26*lb;* No. VI., 4*cwt.* 0*qr.* 22*lb.* at 71*s.* 6*d. per cwt;* tare 12*lb. per cwt.*
5 casks of American ashes, at 28*s.* 3*d. per cwt;* No. IV., 1*cwt.* 2*qr.* 13*lb;* No. VI., 2*cwt.* 0*qr.* 7*lb;* No. VII., 1*cwt.* 0*qr.* 27*lb;* No. IX., 3*cwt.* 0*qr.* 5*lb;* No. XIII., 1*cwt.* 1*qr.* 15*lb.*
Tare 15*lb. per cwt.*

12*th July*, 1849, SOLD—

(35) 3 casks of gum; No. II., 7*cwt.* 3*qr.* 14*lb.* at 61*s.* 6*d. per cwt;* No. III., 9*cwt.* 0*qr.* 5*lb.* at 63*s.* 8*d;* No. IV., 7*cwt.* 0*qr.* 2*lb.* at 67*s.* 6*d,* tare 15*lb. per cwt.* 105¼*lb.* of

indigo, at 9*s.* 4*d. per lb;* 76¾*lb.* at 10*s.* 6*d. per pound;* 3½*cwt.* of cochineal, at 12*s.* 6*d. per pound;* 1 bag of French berries, 3*cwt.* 2*qr.* 17*lb.* at 35*s.* 4*d. per cwt.*

21*st July*, 1849, SOLD—

(36) 5*cwt.* 2*qr.* 16*lb.* of iron, at 21*s.* 6*d. per cwt;* 96*lb.* at 2¼*d. per pound;* 5 *tons*, 15*cwt.* 3*qr.* 16*lb.* at 2¼*d. per pound;* 63¾*lb.* at 23*s.* 4*d. per cwt;* 6*cwt.* 3*qr.* 13*lb.* at 2¾*d. per pound;* 333½*lb.* at 22*s.* 3*d. per cwt;* 19¼*lb.* at 20*l.* 2*s.* 6*d. per ton;* 42¾*lb.* at 2½*d. per pound.*

26*th July*, 1849, SOLD—

(37) 3*cwt.* 2*qr.* 14*lb.* of lead, at 1¾*d. per pound;* 6 fothers, at 15*s.* 6*d. per cwt;* 142*lb.* at 17*s.* 2*d. per cwt;* 2½ fothers, at 2¼*d. per lb;* 6*cwt.* 3*qr.* 21*lb.* at 18*s.* 1*d. per cwt;* 19*cwt.* 0*qr.* 27*lb.* at 15*s.* 2*d. per cwt;* 13*cwt.* 1*qr.* 25*lb.* at 15*l.* 3*s.* 6½*d. per fother;* 231¾*lb.* at 15*l.* 3*s.* 6½*d. per fother.*

Patrick Higgins, of Newry, bought for T. Bell, of London.

(38) 6 casks of Irish butter, each 1*cwt.* 2*qr.* 19*lb.* gross, tare 11½*lb. per cask*, at 77*s.* 6*d. per cwt;* 9 do. each 1*cwt.* 7*lb*, tare 9*lb. per cwt.* at 79*s;* 12 do. each 1*cwt.* 3*qr.* 13*lb*, tare 14*lb. per cwt.* at 82*s.* 6*d;* 13 do. each 1*cwt.* 1*qr.* 17*lb*, tare 13*lb. per cwt.* at 91*s.* 9*d;* 11 do. each 1*cwt.* 2*qr.* 21*lb*, tare 11*lb. per cwt.* at 93*s.* 3*d;* 3 do. each 2*cwt.* 0*qr.* 19*lb*, tare 19*lb. per cwt.* at 93*s.* 3*d;* commission 1½*l. per cent*, porterage and charge of shipping, 6*d. per cwt.* gross; how much must T. B. remit, exchange 9¾*l. per cent?*

27*th July*, 1849, SOLD—

(39) 5 *tons*, 17*cwt.* 1*qr.* logwood, at 13½ guineas *per ton;* 11 *tons*, 5*cwt.* 2*qr.* at 29*l.* 6*s.* 6*d. per ton;* 13 *tons*, 14*cwt.* 17*lb.* shumack, at 30 guineas *per ton;* 15 *tons*, 7*cwt.* 19*lb.* fustic, at 27*l.* 13*s.* 9*d. per ton;* with the above goods I am to have 6 months' credit, what shall I have deducted on paying present bill?

28*th July*, 1849, BOUGHT OF—

(40) 3*hhds.* of tallow, weighing each 6*cwt.* 3*qr.* 27*lb.* at 42*s.* 9*d. per cwt;* 4*hhds.* weighing 19*cwt.* 1*qr.* 19*lb.* at 44*s.* 6*d;* 2*hhds.* each 4*cwt.* 2*qr.* 26*lb.* at 47*s.* 8*d;* 5*hhds.* each 3*cwt.* 9*lb.* at 48*s.* 6*d;* 6*hhds.* each 4*cwt.* 3*qr.* 22*lb.* at 50*s.* 6*d;* 7*hhds.* weighing 3 *tons*, 16*lb.* at 53*s.* 10*d. per cwt.*

Tare 17*lb. per cwt.*

Brandy without Duty, &c.

(41) 467*gal.* 3*qt.* 1*pt.* 1 *gill,* at 3*s.* 8*d. per gal ;* 593*gal.* 1*qt.* 1*pt.* 1 *gill,* at 3*s.* 9*d ;* 765*gal.* 2*qt.* 1*pt.* 1 *gill,* at 3*s.* 9½*d ;* 987*gal.* 3*qt.* 1*pt.* 1 *gill,* at 3*s.* 9¾*d ;* 572*gal.* 1*qt.* 0*pt.* 1¼ *gill,* at 3*s.* 10*d ;* 885*gal.* 3*qt.* 1*pt.* 0½ *gill,* at 3*s.* 11*d ;* 1001*gal.* 2*qt.* 1*pt.* 1¼ *gill,* at 3*s.* 11½*d ;* 572*gal.* 3*qt.* 0*pt.* 0 *gill,* at 4*s.* 1*d ;* 357*gal.* 2*qt.* 0*pt.* 1¾ *gill,* at 4*s.* 1¼*d ;* 293*gal.* 2*qt.* 1*pt.* 1¾ *gill,* at 4*s.* 2*d. per gallon.*

Rhubarb.

(42) 531*lb.* 12*oz.* 10*drs.* at 14*d. per pound ;* 762*lb.* 9*oz.* 11*drs.* at 14½*d ;* 986*lb.* 11*oz.* 13*drs.* at 14¾*d ;* 1055*lb.* 6*oz.* 14*drs.* at 15½*d ;* 758*lb.* 5*oz.* 15*drs.* at 13¼*d ;* 579*lb.* 10*oz.* 10*drs.* at 15*d ;* 385*lb.* 9*oz.* 8*drs.* at 16½*d ;* 295*lb.* 8*oz.* 12*drs.* at 16¾*d ;* 791*lb.* 7*oz.* 2*drs.* at 17½*d ;* 15*lb.* 0*oz.* 15*drs.* at 18¼*d. per lb.*

Port Wine.

(43) 991*gal.* 1*qt.* 1*pt.* 1 *gill,* at 40*l.* 1*s.* 6*d.* for 138 *gallons ;* 715*gal.* 3*qt.* 1*pt.* 0½ *gill,* at 40*l.* 3*s.* 6*d.* for 137*gal ;* 892*gal.* 2*qt.* 1*pt.* 1 *gill,* at 40*l.* 5*s.* 4*d.* for 135*gal ;* 976*gal.* 1*qt.* 1*pt.* 0¾ *gill,* at 40*l.* 17*s.* 6*d.* for 139*gal ;* 376*gal.* 3*qt.* 1*pt.* 1 *gill,* at 41*l.* 1*s.* 3*d.* for 140*gal ;* 982*gal.* 2*qt.* 1*pt.* 1¼ *gill,* at 42*l.* 7*s.* 6*d.* for 143*gal ;* 1008*gal.* 1*qt.* 1*pt.* 1 *gill,* at 42*l.* 9*s.* 8*d.* for 138*gal ;* 5008*gal.* 3*qt.* 1*pt.* 1¾ *gill,* at 44*l.* 10*s.* 11*d.* for 142 *gallons.*

Barrel Flour.

(44) 5 barrels, each 100¾*lb.* at 53*s.* 3*d. per bar.* of 100*lb ;* 9 do. each 101¼*lb.* at 53*s.* 7*d ;* 11 do. each 102½*lb.* at 54*s.* 5*d ;* 16 do. each 101½*lb.* at 54*s.* 10*d ;* 25 do. each 100¼*lb.* at 55*s.* 1*d ;* 41 do. each 100¾*lb.* at 55*s.* 3*d ;* 57 do. each 102¼*lb.* at 55*s.* 6*d ;* 101 do. each 103½*lb.* at 55*s.* 11*d ;* 93 do. each 101¼*lb.* at 56*s.* 0½*d ;* 111 do. each 99¾*lb.* at 57*s.* 1¼*d. per barrel* of 100*lb.*

Cloves.

(45) 956*lb.* 4*oz.* 12*drs.* at 10*s.* 2*d. per lb ;* 872*lb.* 5*oz.* 8*drs.* at 10*s.* 1½*d ;* 386*lb.* 3*oz.* 11*drs.* at 10*s.* 3*d ;* 459*lb.* 2*oz.* 14*drs.* at 10*s.* 9*d ;* 761*lb.* 1*oz.* 13*drs.* at 10*s.* 8½*d ;* 583*lb.* 9*oz.* 7*drs.* at 10*s.* 9¾*d ;* 419*lb.* 10*oz.* 12*drs.* at 11*s.* 2½*d ;* 858*lb.* 11*oz.* 13*drs.* at 12*s.* 5*d ;* 973*lb.* 14*oz.* 3*drs.* at 12*s.* 11*d ;* 397*lb.* 15*oz.* 15*drs.* at 12*s.* 9¾*d. per lb.*

Silver.

(46) 957*oz.* 6*dwts.* 13*grs.* at 5*s.* 9*d. per oz ;* 851*oz.* 13*dwts.* 22*grs.* at 5*s.* 9¼*d ;* 931*oz.* 18*dwts.* 21*grs.* at 5*s.* 9½*d ;* 762*oz.*

16*dwts.* 18*grs.* at 5*s.* 9¾*d*; 448*oz.* 11*dwts.* 12*grs.* at 6*s.* 1*d*; 819*oz.* 9*dwts.* 9*grs.* at 6*s.* 0¼*d*; 918*oz.* 7*dwts.* 7*grs.* at 6*s.* 2½*d*; 189*oz.* 5*dwts.* 23*grs.* at 6*s.* 3*d*; 198*oz.* 4*dwts.* 15*grs.* at 5*s.* 9½*d*; 309*oz.* 3*dwts.* 11*grs.* at 6*s.* 0¾*d. per oz.*

Oats per Quarter, Winchester.

(47) 956*q.* 7*bush.* 3*pk.* at 71*s.* 3*d. per quarter*; 878*q.* 6*b.* 2*p.* at 70*s.* 9*d*; 578*q.* 3*b.* 1*p.* at 71*s.* 6*d*; 857*q.* 1*b.* 3*p.* at 72*s.* 8*d*; 875*q.* 5*b.* 3*p.* at 73*s.* 5*d*; 587*q.* 6*b.* 2*p.* at 75*s.* 8*d*; 942*q.* 7*b.* 1*p.* at 76*s.* 7*d*; 429*q.* 2*b.* 1*p.* at 79*s.* 11*d*; 763*q.* 3*b.* 2*p.* at 80*s.* 1*d*; 999*q.* 5*b.* 3*p.* at 91*s.* 10*d. per quarter.*

Pot Ashes per cwt.

(48) No. I., 3*cwt.* 1*qr.* 17*lb.* at 51*s.* 6*d*; No. II., 2*cwt.* 3*qr.* 19*lb.* at 51*s.* 10*d*; No. III., 3*cwt.* 0*qr.* 8*lb.* at 52*s.* 3*d*; No. IV., 3*cwt.* 2*qr.* 15*lb.* at 53*s.* 7*d*; No. V., 3*cwt.* 3*qr.* 18*lb.* at 53*s.* 9*d*; No. VI., 2*cwt.* 3*qr.* 26*lb.* at 54*s.* 1*d*; No. VIII., 3*cwt.* 2*qr.* 25*lb.* at 54*s.* 11*d*; No. IX., 4*cwt.* 0*qr.* 14*lb.* at 55*s.* 11½*d*; No. X., 3*cwt.* 1*qr.* 22*lb.* at 55*s.* 1¼*d*; No. XII., 3*cwt.* 2*qr.* 12*lb.* at 55*s.* 8¾*d. per cwt.*

Coffee.

(49) 8 bags, each 2*cwt.* 1*qr.* at 81*s. per cwt*; 5 do. each 3*cwt.* 2*qr.* at 81*s.* 3*d*; 7 do. each 1*cwt.* 3*qr.* at 81*s.* 8*d*; 4 do. each 2*cwt.* 3*qr.* at 82*s.* 7*d*; 6 do. each 2*cwt.* 2*qr.* at 90*s.* 3*d*; 8 do. each 3⅛*cwt.* at 90*s.* 10*d*; 9 do. each 2*cwt.* 1*qr.* at 90*s.* 11½*d*; 11 do. each 3*cwt.* 1*qr.* at 92*s.* 4*d*; 12 do. each 2*cwt.* 3*qr.* at 92*s.* 5¼*d*; 14 do. each 3*cwt.* 2*qr.* at 93*s.* 7¾*d. per cwt.*

(50) 1 barrel of American pitch, 3*cwt.* 1*qr.* 17*lb.* at 14*s.* 2*d. per cwt*; 3*cwt.* 0*qr.* 21½*lb.* at 15*s.* 9*d*; 2*cwt.* 3*qr.* 27*lb.* at 16*s.* 4½*d*; 3*cwt.* 2*qr.* 19*lb.* at 17*s.* 1¼*d*; 4*cwt.* 3*qr.* 19*lb.* at 18*s.* 4¾*d*; 3*cwt.* 1*qr.* 22¼*lb.* at 19*s.* 1¼*d*; 3*cwt.* 2*qr.* 25*lb.* at 20*s.* 1½*d*; 4*cwt.* 0*qr.* 23*lb.* at 21*s.* 9¼*d*; 3*cwt.* 3*qr.* 15*lb.* at 21*s.* 10½*d*; 4*cwt.* 1*qr.* 13*lb.* at 22*s.* 3¾*d. per cwt.*

Foreign Brimstone.

(51) 13 *tons*, 14*cwt.* 1*qr.* 18*lb.* at 25*l.* 6*s.* 6*d. per ton*; 16 *tons*, 13*cwt.* 1*qr.* 22*lb.* at 25*l.* 9*s.* 2*d*; 15 *tons*, 9*cwt.* 3*qr.* 17*lb.* at 26*l.* 18*s.* 6*d*; 18 *tons*, 17*cwt.* 2*qr.* 25*lb.* at 26*l.* 19*s.* 1*d*; 12 *tons*, 6*cwt.* 3*qr.* 20*lb.* at 27*l.* 2*s.* 2*d*; 14 *tons*, 3*cwt.* 1*qr.* 27*lb.* at 27*l.* 3*s.* 8*d*; 23 *tons*, 2*cwt.* 1*qr.* 15½*lb.* at 26*l.* 7*s.* 6*d*; 19 *tons*, 11*cwt.* 3*qr.* 22¾*lb.* at 27*l.* 6*s.* 8*d*; 215 *tons*, 13*cwt.* 2*qr.* 13*lb.* at 27*l.* 5*s.* 9*d*; 365 *tons*, 15*cwt.* 1*qr.* 21*lb.* at 27*l.* 8*s.* 7*d. per ton.*

Juniper Berries.

(52) 5*cwt.* 1*qr.* 20*lb.* at 51*s.* 9*d. per cwt;* 3*cwt.* 0*qr.* 18*lb.* at 53*s.* 2*d;* 12*cwt.* 3*qr.* 21*lb.* at 54*s.* 1*d;* 17*cwt.* 1*qr.* 12*lb.* at 55*s.* 10*d;* 16*cwt.* 3*qr.* 8*lb.* at 56*s.* 7*d;* 18*cwt.* 1*qr.* 7*lb.* at 57*s.* 11*d;* 19*cwt.* 3*qr.* 15*lb.* at 58*s.* 10½*d;* 18*cwt.* 2*qr.* 27½*lb.* at 61*s.* 9¼*d;* 19*cwt.* 1*qr.* 15*lb.* at 61*s.* 9½*d;* 23*cwt.* 3*qr.* 7*lb.* at 61*s.* 11¼*d. per cwt.*

8 *Casks of Soap Tallow, tare* 12*lb. per cwt. of* 120*lb.*

(53) No. IV., 9*cwt.* 3*qr.* 19*lb;* No. V., 9*cwt.* 1*qr.* 15*lb;* No. VI., 10*cwt.* 2*qr.* 17*lb;* No. VII., 9*cwt.* 2*qr.* 26*lb.* at 63*s.* 6*d. per cwt;* No. VIII., 9*cwt.* 1*qr.* 18*lb;* No. IX., 11*cwt.* 0*qr.* 21*lb;* No. X., 9*cwt.* 2*qr.* 23*lb;* No. XI., 8*cwt.* 3*qr.* 25*lb.* at 65*s.* 7*d. per cwt.*

10 *Casks of Gum Arabic.*

(54) No. VII., 2*cwt.* 1*qr.* 10*lb,* tare 25*lb.* at 50*s.* 4*d. per cwt;* No. IX., 2*cwt.* 0*qr.* 7*lb,* tare 21*lb.* at 51*s.* 3*d;* No. VIII., 3*cwt.* 1*qr.* 19*lb,* tare 41*lb.* at 52*s.* 5*d;* No. VI., 2*cwt.* 3*qr.* 15*lb,* tare 37*lb.* at 51*s.* 7*d;* No. V., 1*cwt.* 3*qr.* 17*lb,* tare 18*lb.* at 51*s.* 9*d;* No. III., 3*cwt.* 0*qr.* 5*lb,* tare 35*lb.* at 52*s.* 8*d;* No. X., 2*cwt.* 2*qr.* 2*lb,* tare 31*lb.* at 53*s.* 1*d;* No. XI., 3*cwt.* 1*qr.* 1*lb,* tare 34*lb.* at 53*s.* 11*d;* No. XII., 4*cwt.* 0*qr.* 1*lb,* tare 42*lb.* at 52*s.* 10*d;* No. XIII., 3*cwt.* 1*qr.* 22*lb,* tare 39*lb.* at 51*s.* 6½*d. per cwt.*

Logwood.

(55) Campeachy logwood, 4 lots, Jamaica, 6 lots, 4 logs, each 9*cwt.* 3*qr.* 15*lb.* at 18*l.* 6*s.* 6*d. per ton;* 3 do. each 8*cwt.* 2*qr.* 17*lb.* at 18*l.* 16*s.* 2*d;* 6 do. each 5*cwt.* 1*qr.* 22*lb.* at 19*l.* 1*s.* 3*d;* 8 do. each 11*cwt.* 0*qr.* 23*lb.* at 19*l.* 11*s.* 8*d.* Jamaica, 8 do. each 4*cwt.* 3*qr.* 6*lb.* at 15*l.* 5*s.* 10*d;* 11 do. each 12*cwt.* 3*qr.* 26*lb.* at 15*l.* 11*s.* 11*d;* 12 do. each 4*cwt.* 1*qr.* 16*lb.* at 15*l.* 13*s.* 7*d;* 14 do. each 10*cwt.* 2*qr.* 15*lb.* at 16*l.* 9*s.* 5*d;* 15 do. each 7*cwt.* 1*qr.* 18*lb.* at 16*l.* 7*s.* 4*d;* 17 do. each 6*cwt.* 3*qr.* 12*lb.* at 16*l.* 19*s.* 11*d. per ton.*

Cotton.

(56) Upland, new, No. V., 3*cwt.* 1*qr.* 5*lb.* at 18¼*d. per lb;* do. old, No. IV., 2*cwt.* 3*qr.* 9*lb.* at 17½*d;* Sea Island, fine, No. VI., 2*cwt.* 0*qr.* 17*lb.* at 2*s.* 2¼*d;* do. middling, No. VIII., 3*cwt.* 1*qr.* 7*lb.* at 23½*d;* do. stained, No. VII., 2*cwt.* 1*qr.* 22*lb.* at 19¼*d;* New Orleans, No. III., 3*cwt.* 0*qr.* 7*lb.* at 19¾*d;* Tenesse, No. II., 2*cwt.* 3*qr.* 24*lb.* at 21½*d;* Pernambucco, No. VII., 1*cwt.* 3*qr.* 27*lb.* at 2*s.* 0½*d;* Bahia, No. XII., 2*cwt.* 2*qr.* 20*lb.* at 2*s.* 2¼*d;*

Demerara, No. I., 3*cwt.* 0*qr.* 23*lb.* at 23¾*d*; Rio, No. XIII., 2*cwt.* 1*qr.* 18*lb.* at 18½*d*; Maranham, No. IX., 2*cwt.* 1*qr.* 9*lb.* at 2*s.* 1¾*d. per lb.*

(57) Surinam, 3*cwt.* 2*qr.* 5*lb.* gross, tare 5¼*lb.* at 2*s.* 1½*d. per lb*; Cayenne, 2*cwt.* 3*qr.* 1*lb*, tare 4½*lb.* at 2*s.* 1¼*d*; St. Domingo, 3*cwt.* 1*qr.* 9*lb*, tare 6¾*lb.* at 1*s.* 6¾*d*; Barbadoes, 3*cwt.* 0*qr.* 17*lb*, tare 6½*lb.* at 1*s.* 9¼*d*; West India, 2*cwt.* 3*qr.* 21*lb*, tare 5½*lb.* at 1*s.* 8½*d*; Bourbon, 3*cwt.* 3*qr.* 17*lb*, tare 6¾*lb.* at 4*s.* 1½*d*; Carthagena, 3*cwt.* 3*qr.* 24*lb*, tare 6¾*lb.* at 1*s.* 5¼*d*; Smyrna, 2*cwt.* 3*qr.* 5*lb*, tare 7¼*lb.* at 1*s.* 3¾*d*; Surats, long, 3*cwt.* 1*qr.* 11*lb*, tare 7¾*lb.* at 1*s.* 3½*d*; Surats, short, 4*cwt.* 0*qr.* 8*lb*, tare 8½*lb.* at 1*s.* 2¾*d. per lb.*

Muscovado Sugar, 10 *Casks.*

(58) No. I., 4*cwt.* 3*qr.* 6*lb.* gross, tare 57*lb.* at 3*l.* 12*s.* 4*d. per cwt*; No. II., 5*cwt.* 1*qr.* 19*lb*, tare 61*lb.* at 3*l.* 13*s.* 5*d*; No. III., 4*cwt.* 0*qr.* 17*lb*, tare 54*lb.* at 3*l.* 15*s.* 7*d*; No. IV., 3*cwt.* 3*qr.* 26*lb*, tare 49*lb.* at 3*l.* 2*s.* 9*d*; No. V., 4*cwt.* 2*qr.* 24*lb*, tare 62*lb.* at 3*l.* 7*s.* 11*d*; No. VI., 5*cwt.* 0*qr.* 19*lb*, tare 63*lb.* at 3*l.* 4*s.* 8*d*; No. VII., 4*cwt.* 2*qr.* 25*lb*, tare 51*lb.* at 3*l.* 1*s.* 3*d*; No. VIII., 5*cwt.* 1*qr.* 13*lb*, tare 62*lb.* at 3*l.* 9*s.* 2*d*; No. IX., 4*cwt.* 1*qr.* 18*lb*, tare 48*lb.* at 3*l.* 3*s.* 1*d*; No. X., 5*cwt.* 3*qr.* 7*lb*, tare 64*lb.* at 3*l.* 14*s.* 10*d. per cwt.*

10 *Casks of American Pitch.*

(59) 4*cwt.* 3*qr.* 15*lb*, tare 13*lb. per cwt.* at 14*s.* 6*d. per cwt*; 5*cwt.* 2*qr.* 7*lb*, tare 12*lb.* at 14*s.* 8*d*; 3*cwt.* 1*qr.* 19*lb*, tare 15*lb.* at 14*s.* 10*d*; 4*cwt.* 2*qr.* 20*lb*, tare 11*lb.* at 14*s.* 11*d*; 4*cwt.* 1*qr.* 22*lb*, tare 8*lb.* at 15*s.* 3*d*; 4*cwt.* 0*qr.* 24*lb*, tare 12*lb.* at 16*s.* 7*d*; 3*cwt.* 3*qr.* 17*lb*, tare 15*lb.* at 17*s.* 8*d*; 4*cwt.* 2*qr.* 18*lb*, tare 13*lb.* at 17*s.* 11*d*; 3*cwt.* 3*qr.* 10*lb*, tare 14*lb.* at 18*s.* 1*d*; 4*cwt.* 2*qr.* 3*lb*, tare 18*lb.* at 19*s.* 5*d. per cwt.*

Madder, 10 *Casks.*

(60) No. I., 4*cwt.* 2*qr.* 12*lb.* gross, tare 15*lb. per cwt.* at 4*l.* 10*s.* 6*d. per cwt*; No. II., 5*cwt.* 2*qr.* 7*lb*, tare 13*lb.* at 4*l.* 11*s.* 9*d*; No. III., 4*cwt.* 2*qr.* 17*lb*, tare 12*lb.* at 4*l.* 12*s.* 1*d*; No. IV., 4*cwt.* 3*qr.* 5*lb*, tare 9*lb.* at 4*l.* 13*s.* 5*d*; No. V., 5*cwt.* 1*qr.* 19*lb*, tare 16*lb.* at 4*l.* 13*s.* 11*d*; No. VI., 4*cwt.* 2*qr.* 9*lb*, tare 17*lb.* at 4*l.* 14*s.* 6*d*; No. VII., 3*cwt.* 3*qr.* 26*lb*, tare 15*lb.* at 4*l.* 15*s.* 10*d*; No. VIII., 4*cwt.* 1*qr.* 22*lb*, tare 14*lb.* at 4*l.* 17*s.* 6*d*; No. IX., 4*cwt.* 3*qr.* 9*lb*, tare 11*lb.* at 4*l.* 18*s.* 8*d*; No. X., 5*cwt.* 0*qr.* 12*lb*, tare 10*lb.* at 4*l.* 19*s.* 2*d. per cwt.*

Pot Ashes, 10 *Casks.*

(61) 4, each 2*cwt.* 1*qr.* 9*lb*, tare 41*lb. per cask*, at 51*s.* 9*d. per cwt;* 12, each 3*cwt.* 1*qr.* 16*lb*, tare 43*lb.* at 51*s.* 11*d;* 9, each 3*cwt.* 2*qr.* 6*lb*, tare 45*lb.* at 51*s.* 4*d;* 4, each 4*cwt.* 2*qr.* 5*lb*, tare 49*lb.* at 51*s.* 2*d;* 15, each 4*cwt.* 1*qr.* 18*lb*, tare 51*lb.* at 52*s.* 7*d;* 26, each 4*cwt.* 0*qr.* 23*lb*, tare 53*lb.* at 53*s.* 8*d;* 17, each 3*cwt.* 3*qr.* 25*lb*, tare 41*lb.* at 55*s.* 6*d;* 18, each 2*cwt.* 3*qr.* 27*lb*, tare 39*lb.* at 55*s.* 7*d;* 19, each 3*cwt.* 0*qr.* 21*lb*, tare 37*lb.* at 54*s.* 1*d;* 20, each 4*cwt.* 1*qr.* 3*lb*, tare 52*lb.* at 58*s.* 11*d. per cwt.*

12 *Casks of Pearl Ashes.*

(62) No. I., 5, each 3*cwt.* 3*qr.* 7*lb*, tare 13*lb. per cwt.* at 61*s.* 8*d. per cwt;* No. II., 9, each 3*cwt.* 2*qr.* 22*lb*, tare 10*lb.* at 60*s.* 5*d;* No. III., 11, each 2*cwt.* 2*qr.* 26*lb*, tare 8*lb.* at 59*s.* 7*d;* No. IV., 12, each 3*cwt.* 0*qr.* 18*lb*, tare 12*lb.* at 60*s.* 10*d;* No. V., 13, each 3*cwt.* 1*qr.* 5*lb*, tare 13*lb.* at 61*s.* 4*d;* No. VI., 14, each 3*cwt.* 3*qr.* 2*lb*, tare 14*lb.* at 62*s.* 6*d;* No. VII., 3, each 2*cwt.* 2*qr.* 19*lb*, tare 16*lb.* at 63*s.* 4*d;* No. VIII., 15, each 3*cwt.* 3*qr.* 22*lb*, tare 19*lb.* at 61*s.* 11*d;* No. IX., 17, each 2*cwt.* 1*qr.* 24*lb*, tare 15*lb.* at 60*s.* 2*d;* No. X., 19, each 3*cwt.* 3*qr.* 21*lb*, tare 9*lb.* at 61*s.* 3*d;* No. XI., 20, each 3*cwt.* 3*qr.* 3*lb*, tare 17*lb.* at 62*s.* 4*d;* No. XII., 23, each 3*cwt.* 0*qr.* 15*lb*, tare 18*lb.* at 63*s.* 9*d. per cwt.*

Pigs of Lead, 120*lbs. to cwt.*

(63) 13, each 2*qr.* 18*lb.* at 31*l.* 8*s. per ton;* 15, each 3*cwt.* 1*lb.* at 31*l.* 9*s.* 2*d;* 17, each 2*qr.* 17*lb.* at 32*l.* 11*s.* 7*d;* 23, each 2*qr.* 15*lb.* at 31*l.* 14*s.* 8*d;* 22, each 2*qr.* 22*lb.* at 31*l.* 9*s.* 5*d;* 26, each 3*qr.* 13*lb.* at 30*l.* 17*s.* 11*d;* 29, each 2*qr.* 27*lb.* at 30*l.* 18*s.* 10*d;* 31, each 3*qr.* 13*lb.* at 30*l.* 15*s.* 4*d;* 37, each 3*qr.* 11*lb.* at 31*l.* 13*s.* 7*d;* 43, each 2*qr.* 19*lb.* at 32*l.* 3*s.* 4*d;* 47, each 2*qr.* 23*lb.* at 32*l.* 2*s.* 11*d;* 51, each 2*qr.* 26*lb.* at 32*l.* 1*s.* 9*d. per ton.*

Casks of Sugar.

(64) 14, each 3*cwt.* 1*qr.* 15*lb*, tare 15*lb. per cwt.* at 3*l.* 11*s.* 3*d. per cwt;* 11, each 3*cwt.* 0*qr.* 19*lb*, tare 16½*lb.* at 3*l.* 11*s.* 7*d;* 15, each 3*cwt.* 2*qr.* 17*lb*, tare 13¾*lb.* at 3*l.* 11*s.* 10*d;* 17, each 3*cwt.* 3*qr.* 2*lb*, tare 14¼*lb.* at 3*l.* 11*s.* 11*d;* 19, each 3*cwt.* 1*qr.* 17*lb*, tare 15½*lb.* at 3*l.* 12*s.* 2*d;* 7, each 3*cwt.* 1*qr.* 23*lb*, tare 16¼*lb.* at 3*l.* 12*s.* 5½*d;* 9, each 3*cwt.* 2*qr.* 21*lb*, tare 12½*lb.* at 3*l.* 12*s.* 7¼*d;* 17, each 3*cwt.* 1*qr.* 22*lb*, tare 11¾*lb.* at 3*l.* 12*s.* 11*d;* 21, each 3*cwt.* 2*qr.* 15*lb*, tare 16¼*lb.* at 3*l.* 13*s;* 23, each 3*cwt.* 3*qr.* 1*lb*, tare 13½*lb.* at 3*l.* 13*s.* 9*d;* 26, each 3*cwt.*

2*qr.* 25*lb*, tare 9*lb*. at 3*l*. 15*s*. $7\frac{3}{4}d$; 29, each 3*cwt*. 0*qr*. 27*lb*, tare $10\frac{3}{4}lb$. at 3*l*. 14*s*. $5\frac{1}{2}d$. *per cwt*.

East India Produce.

(65) Mace, 16*lb*. 13*oz*. 12*drs*. at 2*s*. $7\frac{1}{2}d$. *per lb*; Opium, 14*lb*. 12*oz*. 15*drs*. at 1*s*. $3\frac{1}{4}d$. *per lb*; Musk, 7*lb*. 3*oz*. 4*drs*. at 22*s*. $3\frac{3}{4}d$. *per oz*; Gum Arabic, 15*tons*, 17*cwt*. 3*qr*. 13*lb*. at 75*s*. 8*d*. *per cwt*; Indigo, 171*lb*. 9*oz*. 12*drs*. at 11*s*. $7\frac{1}{4}d$. *per lb*; Nutmegs, 119*lb*. 13*oz*. 15*drs*. at 1*s*. $5\frac{3}{4}d$. *per lb*; Turmeric, 17 *tons*, 19*cwt*. 2*qr*. 22*lb*. at 78*s*. 11*d*. *per cwt*; Stick Lac, 19 *tons*, 13*cwt*. 3*qr*. 19*lb*. at 9*l*. 19*s*. 5*d*. *per cwt*; Pepper, 113*lb*. 8*oz*. 9*drs*. at 2*s*. $5\frac{1}{4}d$. *per lb*; Tea, best, 191*lb*. 2*oz*. 11*drs*. at 1*s*. $11\frac{1}{2}d$. *per lb*; Sugar, 17 *tons*, 12*cwt*. 3*qr*. 5*lb*. at 43*l*. 5*s*. 2*d*. *per ton*.

St. Domingo Cotton.

(66) 7 bags, each 3*cwt*. 1*qr*. 17*lb*. gross, tare $5\frac{1}{4}lb$. *per bag*, at $17\frac{3}{4}d$. *per lb*; 9 do. each 2*cwt*. 3*qr*. 19*lb*, tare $6\frac{1}{2}lb$. at $17\frac{1}{4}d$; 13 do. each 3*cwt*. 2*qr*. 4*lb*, tare $7\frac{1}{4}lb$. at $18\frac{1}{4}d$; 25 do. each 3*cwt*. 1*qr*. 8*lb*, tare $6\frac{3}{4}lb$. at $18\frac{1}{2}d$; 31 do. each 3*cwt*. 2*qr*. 9*lb*, tare $6\frac{1}{2}lb$. at $19\frac{1}{4}d$; 26 do. each 3*cwt*. 1*qr*. 21*lb*, tare $5\frac{3}{4}lb$. at $19\frac{1}{2}d$; 17 do. each 3*cwt*. 0*qr*. 11*lb*, tare $9\frac{1}{4}lb$. at $18\frac{3}{4}d$; 13 do. each 3*cwt*. 2*qr*. 19*lb*, tare $8\frac{1}{2}lb$. at $18\frac{1}{2}d$; 16 do. each 3*cwt*. 1*qr*. 14*lb*, tare $7\frac{1}{2}lb$. at $17\frac{3}{4}d$; 11 do. each 3*cwt*. 1*qr*. 23*lb*, tare $8\frac{1}{4}lb$. at $18\frac{1}{4}d$; 7 do. each 3*cwt*. 0*qr*. 26*lb*, tare $9\frac{1}{2}lb$. at $19\frac{1}{4}d$; 29 do. each 4*cwt*. 0*qr*. 10*lb*, tare $10\frac{3}{4}lb$. at $18\frac{3}{4}d$. *per lb*.

QUESTIONS

TO EXERCISE ALL THE FOREGOING RULES.

(1) What is the interest and amount of 915*l*. 15*s*. 8*d*. for $5\frac{3}{4}$ years, at $4\frac{3}{4}l$. *per cent?*

(2) Bought 6 pieces of printed calico, each $29\frac{1}{2}$ yards, at 2*s*. 5*d*. *per yard*, and 3 pieces of thickset, each $44\frac{1}{4}$ yards, at 3*s*. 8*d*. *per yard*, I am to pay for them in 4 months; what shall I have to pay present money *?

(3) Gave 75*s*. *per cwt*. for sugar, how must I sell it *per cwt*. to lose no more than $7\frac{1}{2}l$. *per cent?*

(4) Lent a friend 250*l*. for $7\frac{1}{2}$ years, at which time I received 387*l*. 10*s*. what did he pay me *per cent?*

(5) If $12\frac{1}{4}cwt$. be carried 30 miles for 3*s*. 2*d*. *per cwt*, how far may $29\frac{3}{4}cwt$. be carried for $7\frac{3}{4}$ guineas?

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* In calculating interest, it is customary to allow 5*l*. per cent.

(6) How long must I lend 500*l.* to double itself at $4\frac{1}{2}$*l. per cent.* simple interest?

(7) A house cost 750*l.* building, for how much must it be let a year to pay 8*l. per cent?*

(8) Bought 5*cwt.* 2*qr.* 16*lb.* gross of sugar, tare 15*lb. per cwt.* at 84*s.* 9*d. per cwt;* it proving worse than I expected, I must lose $6\frac{3}{4}$*l. per cent.* by it, how much shall I lose by the whole?

(9) If 54*lb.* of bread serve 6 soldiers 7 days, how much will the bread of 10000 men cost for 6 months, when bread is $2\frac{1}{4}$*d. per lb?*

(10) Lent a friend 265*l.* 16*s.* 6*d.* for $2\frac{3}{4}$ months, how long ought he to lend me 250*l.* 16*s.* 3*d.* to balance the account?

(11) At what rate of simple interest will 250*l.* gain 87*l.* 10*s.* in 7 years?

(12) A began trade with 240*l;* at the end of 6 months, B entered into partnership with him, and advanced 480*l;* at the year's end, their whole stock amounted to 1000*l;* what is each man's share of the gain?

(13) By selling corn at 8*s. per bushel,* I gain 10*l. per cent,* but on selling the same at 7*s. per bushel,* what was my gain or loss *per cent?*

(14) Remitted to Belfast 574*l.* 15*s.;* how much Irish butter will it pay for at 95*s.* 6*d. per cwt,* exchange $7\frac{1}{2}$*l. per cent?*

(15) By selling quills at 11*s. per* 1000, I clear 60*l. per cent,* how much shall I clear *per cent.* by advancing them 2*s.* 6*d. per* 1000?

(16) At 5*s.* 4*d. per gallon,* what will be the value of 7*hhds.* of oil, each 3*cwt.* 2*qr.* 14*lb.* gross, tare 21*lb. per cwt?*

(17) How many pieces of cloth, each 34 yards, at 18*s.* 6*d. per yard,* must be given for 50 pieces of flannel, each $42\frac{1}{2}$ yards, at $16\frac{1}{2}$*d. per yard?*

(18) How many pieces of printed calico, each $28\frac{1}{2}$ yards, at 2*s.* $2\frac{1}{2}$*d.* may I have for $13\frac{3}{4}$ tons of fustic, at $15\frac{1}{2}$ guineas *per ton?*

(19) A person coming from France, brings with him 542 livres, 11 sols, $9\frac{1}{4}$ deniers, how much English money will he receive for it, the exchange $54\frac{1}{2}$*d. per écu?*

(20) At what rate will 300*l.* amount to 350*l.* 12*s.* 6*d.* in $4\frac{1}{2}$ years, simple interest?

(21) If 96 men can build a wall 10 feet high, and 100 yards long, in 48 days; how many men would do the same in 384 days?

(22) Sold 6 pipes of wine at 7*s.* 6*d. per gallon,* and gained $12\frac{1}{2}$*l. per cent,* what did the 6 pipes cost me, and what was my whole gain?

(23) A person going to Ireland, takes with him 150 guineas, how much will it be worth there, exchange at 9*l. per cent?*

(24) In what time will 150*l.* gain 25*l.* 6*s.* 3*d.* at $3\frac{3}{4}$*l. per cent?*

(25) What quantity of American flour, at 32*s.* 6*d. per barrel*, currency, can I have for 200 pieces of printed calico, each 28 yards, at 2*s. per yard*, exchange 30*l. per cent?*

(26) I have received 448 barrels of American flour, at 32*s.* 6*d. per barrel*, and 4*s.* 3*d. per barrel* freight, currency, how must I sell them *per barrel* to gain 50*l. per cent* sterling, exchange 30*l. per cent?*

(27) What sum will gain 50*l.* 12*s.* 6*d.* in $4\frac{1}{2}$ years, at $3\frac{3}{4}$*l. per cent?*

(28) A person going to France, takes with him 153*gs.* how much French money will he receive for them at Paris, exchange $52\frac{5}{8}$*d. per écu?*

(29) John has currants at 7*d. per pound*, ready money, but in barter he values them at 9*d. per pound;* James has sugar at 84*s.* 8*d. per cwt;* how much must he advance it to be on footing with John, and what quantity must he give for 17*cwt.* 3*qr.* 25*lb.* of currants?

(30) Sold 65734 pounds of tobacco at $22\frac{1}{4}$*d. per pound*, by which I gained 26*l. per cent;* what was the prime cost of the whole, and of one pound?

(31) Required the value of 6*hhds.* of tobacco, at $9\frac{1}{2}$*d. per pound*, weighing, gross, 55*cwt.* 0*qr.* 26*lb*, tare 30*lb. per hhd*, tret and cloff as usual.

(32) If 18 men build a wall 40 feet long, 3 feet thick, and 16 feet high, in 12 days, how many men will build a wall 360 feet long, 8 feet thick, and 10 feet high, in 60 days?

(33) Bought a puncheon of rum for 36*l.* 18*s.*, into which I put $11\frac{1}{2}$ gallons of water, how must I sell it *per gallon* to clear $24\frac{1}{2}$*l. per cent?*

(34) Bought 7 barrels of porter, at 48*s.* 6*d. per barrel*, by which I lost $14\frac{1}{4}$*l. per cent;* how did I sell it *per gallon?*

(35) Required the amount of 450*l.* 17*s.* 6*d.* for 5 years, 8 months, and 18 days, at 4*l*, $4\frac{1}{2}$*l*, and 5*l. per cent.*

(36) Bought a pipe of wine for 73 guineas, which had leaked $15\frac{1}{2}$ gallons, how must I sell the remainder per gallon, so as to neither gain nor lose?

(37) If by trading, 40*l.* gain 32*l.* in 15 months, what sum will gain 48*l.* in 3 months?

(38) My agent in Portugal has sent me invoices of 13 pipes of wine, amounting to 1548 milreas, 500 reas, what is the value of a pipe in sterling money, exchange at 5*s.* $7\frac{1}{2}$*d. per milrea?*

(39) Required the interest of 387*l.* 15*s.* 6*d.* from the 15*th* of January, 1846, to the 25*th* of September following, at $4\frac{1}{4}$*l. per cent.*

(40) By selling hats at 7*s.* 6*d.* a piece, I gained $6\frac{3}{4}$*l. per cent;*

what did I gain or lose *per cent*, by selling the same at 5*s.* 9*d.* a piece?

(41) Two lots of tobacco weighing 10*cwt.* 1*qr.* 18*lb*, and cost 102*l.* 4*s.* 6*d*; the difference of their weight is 1*cwt.* 3*qr.* 6*lb*, and of their price 5*l.* 16*s.* 8*d*; what is the weight and value of each lot, and how much *per pound* * ?

(42) By selling wool at 9*s.* 8*d. per stone*, I gained 12½*l. per cent*; what did a stone cost me?

(43) Bought 6 *tons*, 11*cwt.* 15*lb.* of cheese, at 57*s.* 6*d. per cwt*, carriage, &c. cost 2*s.* 6*d. per cwt*; how much did I gain by selling it again at 6¾*d. per pound?*

(44) A man sold a horse for 24*l.* and gained one-third of what it cost him, what did the horse cost him?

(45) Bought at 5*s.* 6*d. per ell French*, cambric to the amount of 355*l.* 10*s.* I sold it again at 8*s.* 3*d. per yard*; what did I gain?

(46) How much will pay 43 workmen a month's wages at 2*s.* 4*d. per day* each man?

(47) A man has two debtors, who, together, owe him 375*l.* 6*s.*, but one owes him 99*l.* 11*s.* 6*d.* more than the other, how much does each owe him?

(48) Bought in Holland for 560*l.* a quantity of geneva, at 4*s.* 6*d. per gallon*; on importation, I paid duty, &c., 5*s.* 6*d. per gal.* I sold it again at 14*s.* 6*d. per gal*; what was my gain?

(49) A father left by will 1300*l.* among three children, Bob was to have $\frac{5}{12}$ of it, Ben was to have $\frac{4}{12}$, and Ann $\frac{3}{12}$, required the share of each.

(50) Bought in London a puncheon of geneva, containing 92 gallons, at 15*s. per gallon*, subject to a discount of 5½*d. per gallon*; the freight cost 3*d. per gallon*; what did I gain by selling it at 17*s. per gallon?*

(51) An annuity of 1600 livres was forfeited on the 1*st* of January, 1844; how many francs and cents must be received for it, and how much sterling, exchange 22*fr.* 25*c.* if the claim to it be allowed on the 28*th* of October, 1846?

(52) In consequence of a person leaving France on the 1*st* of January, 1825, he forfeited a chief rent of 1152 livres; how many francs and cents must he receive if his claim be allowed on the 22*nd* of March, 1849?

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* The difference of two numbers taken from their sum leaves twice the less.

VULGAR FRACTIONS.

A vulgar fraction is any part of an unit or integer, and is expressed by two numbers, one written above the other, and a small line drawn between them, as $\frac{3}{4}$ *three-fourths.*

The lower number is called the denominator, which shows into how many parts unity, or any thing is divided; and the higher number is called the numerator, which shows how many such parts are signified by the fraction; so if any thing be divided into 8 equal parts, 7 of those parts will be expressed thus $\frac{7}{8}$ seven-eighths, where 7 is the numerator, and 8 the denominator, *i. e.* unity is to be divided into 8 equal parts, and 7 of those parts are taken.

Or, a fraction is understood to signify the numerator divided by the denominator, so 7 divided by 8 is the value of $\frac{7}{8}$.

A proper fraction has its numerator less than its denominator, and the fraction is less than unity, as $\frac{3}{4}$.

An improper fraction has its numerator equal to or greater than its denominator, and the fraction is equal to or more than unity, as $\frac{3}{3}$ or $\frac{7}{4}$.

A compound fraction is a fraction of a fraction, or a part of a part, being expressed by two fractions, with the word *of* between them, as $\frac{3}{4}$ of $\frac{4}{5}$, where $\frac{4}{5}$ is the whole quantity, of which $\frac{3}{4}$ is to be taken; also $\frac{2}{3}$ of $\frac{7}{8}$ of $\frac{8}{9}$ is a compound fraction, &c.

A mixed number is a fraction annexed to a whole number, and understood to be added thereto, as $5\frac{3}{4}$, read 5 and $\frac{3}{4}$.

REDUCTION OF VULGAR FRACTIONS.

By Reduction we change fractions out of one denomination into another; simple or single fractions to the lowest terms; to a given denominator, or several fractions to one common denominator; compound fractions to single ones; mixed numbers to improper fractions; improper fractions to mixed numbers; the parts of coin, weight, measure, &c., into vulgar fractions; and find the value of a given vulgar fraction in the known part of the integer *.

Case I.

To find the Greatest Common Measure of a Vulgar Fraction.

Rule.—Divide the denominator by the numerator; and the

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* The integer is that of which the fraction is supposed to be a part. Every integer, or whole number, is to be considered as divisible into any number of parts at pleasure.

divisor by the remainder continually, till nothing remains. The last divisor is the greatest common measure sought. (*a*)

EXAMPLES.

(1) What is the greatest common measure of $\frac{21}{24}$?
(2) What is the greatest common measure of $\frac{108}{117}$, of $\frac{1584}{1728}$, of $\frac{7263}{14368}$, $\frac{420}{938}$, of $\frac{10557}{11691}$, and of $\frac{15325}{33745}$?
(3) What is the greatest number which will divide both 735 and 945 without leaving any remainder?

Case II.

To reduce a Vulgar Fraction to its lowest terms.

Rule.—Divide both numerator and denominator by any one and the same number, which will divide both without a remainder, the quotients will be the numerator and denominator of a fraction expressing the same value, and which may be reduced again in the same manner, if you can find a number that will divide both without a remainder; when this is repeated as oft as you can, you may conclude the fraction to be in its lowest terms. Or,

Find the greatest common measure and divide both numerator and denominator thereby, the quotients will be the numerator and denominator respectively, of the fraction in its lowest terms. (*b*)

(*a*) To find the greatest common measure of a vulgar fraction, is to find the greatest number which will divide both numerator and denominator without leaving any remainder. Now to find the greatest common measure of $\frac{49}{168}$, $168 \div 49 = 3\frac{21}{49}$, $49 \div 21 = 2\frac{7}{21}$, and $21 \div 7 = 3$ and 0 remains, wherefore 7, the last divisor, is the greatest common measure sought, *viz.* the greatest number which will divide both 49 and 168 and leave no remainder.

For 7 will divide 21 without a remainder, therefore it will divide twice 21 added to 7, that is, 49, and because it will divide both 49 and 21, it will divide 3 times 49 added to 21, which is 168 still without any remainder; so any number will divide any multiple of itself, added to itself, or any multiple of a multiple, added to a multiple, and to itself, without any remainder, hence the rule.

(*b*) To reduce a fraction to its lowest terms, is to express the same value by smaller numbers.

Find any number by inspection, that will divide both the numerator and denominator without a remainder; proceed in this manner till they cannot be divided by any one and the same number, and this last result will give the fraction in its lowest terms.

The value of the fraction is not altered by this operation; for the numerator still bears to the denominator the same proportion it did before it was divided; thus $9 : 12 :: 3 : 4$, $\therefore \frac{9}{12} = \frac{3}{4}$.

Reduce $\frac{36}{48}$ to its lowest terms; both terms divided by 3 give $\frac{12}{16}$, and

EXAMPLES.

(1) Reduce $\frac{63}{84}$ to its lowest terms.
(2) Reduce $\frac{420}{938}$, $\frac{11556}{11691}$, and $\frac{7268}{14368}$, to their lowest terms.
(3) Reduce $\frac{1584}{1728}$, $\frac{364}{728}$, and $\frac{4678}{5216}$, to their lowest terms.
(4) Reduce $\frac{459}{513}$, $\frac{1679}{2268}$, and $\frac{9672}{13578}$, to their lowest terms.
(5) Reduce $\frac{2\times7\times8\times3}{3\times8\times9\times6}$ to its lowest terms *.

Case III.

To reduce a fraction to a given denominator.

Rule.—As the denominator of the given fraction is to its numerator, so is the denominator of the required fraction to its numerator. (*c*)

EXAMPLES.

(1) Reduce $\frac{12}{15}$ to a fraction with 105 for its denominator.
(2) Reduce $\frac{12}{16}$ to a fraction with 186 for its denominator.
(3) Reduce $\frac{7}{9}$ to a fraction with 117 for its denominator.
(4) Reduce $\frac{28}{32}$ to a fraction with 24 for its denominator.
(5) Reduce $\frac{3}{4}$ to a fraction with 112 for its denominator.
(6) Reduce $\frac{4}{5}$ to a fraction with 161 for its denominator.

Case IV.

To reduce a whole or mixed number to an improper fraction.

Rule.—If it is a whole number without any assigned denominator, write it for a numerator, and 1 for the denominator.—But if it is to have an assigned denominator, multiply the given whole number thereby for a numerator, under which write the said assigned denominator.—For a mixed number, multiply the

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these divided by 4 give $\frac{3}{4}$; ∴ the greatest common measure of $\frac{36}{48}$ is 12, by which dividing both terms make $\frac{3}{4}$ the lowest term sought, ∴ $\frac{36}{48}=\frac{3}{4}$.

* If the terms consist of several numbers connected by the sign of multiplication, cancel and divide as directed in the rule of three, so in $\frac{3\times4\times7\times5}{4\times7\times9\times8}$ the fours and sevens, being cancelled, and the 3 and 9 being divided by 3, the terms or fraction will be reduced to $\frac{1\times5}{3\times8}=\frac{5}{24}$

(*c*) Because two fractions are equal when their numerators bear the same proportion to their denominators, if $\frac{3}{4}$ is to be made into a fraction with 12 for its denominator, 4 : 3 :: 12 : 9 the numerator sought, *viz.* $\frac{3}{4}=\frac{9}{12}$. Sometimes you may find by inspection a number, by which, if you multiply both numerator and denominator, it will reduce the fraction to the required denominator, so $\frac{3}{4}\times\frac{3}{3}=\frac{9}{12}$, *as before.*

whole number by the denominator of the fraction, to the product add the numerator, the sum will be the numerator of the improper fraction required, under which write the denominator of the given fraction. (*d*)

EXAMPLES.

(1) Write 17 as a fraction.
(2) Reduce 17 to a fraction with 7 for its denominator.
(3) Reduce 45 to a fraction with 84 for its denominator.
(4) Reduce $1\frac{3}{4}$ to an improper fraction.
(5) Reduce $17\frac{4}{5}$ to an improper fraction.
(6) Reduce 4, $7\frac{3}{4}$, $18\frac{5}{9}$, and $174\frac{13}{16}$ to improper fractions.
(7) Reduce 21, $21\frac{5}{9}$, $34\frac{2}{35}$, and $108\frac{16}{21}$ to improper fractions.

Case V.

To reduce improper fractions to whole or mixed numbers.

Rule.—Divide the numerator by the denominator, the quotient will be a whole number: the remainder will be a numerator and the divisor a denominator of the remaining fraction. (*e*)

EXAMPLES.

(1) Reduce $\frac{17}{4}$ to a mixed number.
(2) Reduce $\frac{246}{18}$, $\frac{7468}{125}$, and $\frac{284}{27}$, to mixed numbers.
(3) Reduce $\frac{96}{12}$, $\frac{3748}{124}$, and $\frac{912}{12}$, to mixed numbers.
(4) Reduce $\frac{37568}{237}$, and $\frac{37269}{489}$, to mixed numbers.

Case VI.

To reduce compound fractions to single ones.

Rule.—Multiply the numerators together for the numerator, and the denominators together for the denominator of the simple or single fraction sought. (*f*)

(*d*) Every integer or whole number is to be considered as a fraction, whose denominator is 1, thus 7, or seven units, is $\frac{7}{1}$.

If the integer is to have 6 for its denominator, then $\frac{7}{1} \times \frac{6}{6} = \frac{42}{6}$ the fraction required.

Also if $7\frac{3}{4}$ be reduced to an improper fraction, it becomes $\frac{31}{4}$: because 7 reduced to a fraction with 4 for its denominator is $\frac{7}{1} \times \frac{4}{4} = \frac{28}{4}$, and $\frac{3}{4}$ added to this makes it $\frac{31}{4}$.

(*e*) Because a fraction denotes the numerator divided by the denominator, if we would reduce $\frac{246}{18}$ to a mixed number, it is but dividing 246 by 18, the quotient is 13 and $\frac{12}{18}$ remains $\therefore \frac{246}{18} = 13\frac{12}{18} = 13\frac{2}{3}$.

(*f*) A fraction of a fraction is a fraction multiplied by a fraction, so $\frac{2}{3}$ of $\frac{3}{4}$ of $\frac{5}{6}$ is $\frac{2}{3} \times \frac{3}{4} \times \frac{5}{6} = \frac{2 \times 3 \times 5}{3 \times 4 \times 6} = \frac{30}{72} = \frac{5}{12}$

EXAMPLES.

(1) Reduce $\frac{7}{9}$ of $\frac{4}{5}$ of $\frac{5}{8}$ to a simple fraction.
(2) Reduce $\frac{2}{3}$ of $\frac{3}{4}$ to a single fraction and to its lowest terms.
(3) Reduce $\frac{3}{4}$ of $\frac{7}{8}$ of $2\frac{1}{3}$ to a single fraction.
(4) Reduce $\frac{7}{8}$ of $\frac{8}{10}$ of $8\frac{3}{12}$ to a single fraction and to its lowest terms.
(5) Reduce $\frac{3}{5}$ of $\frac{5}{9}$ of $\frac{9}{10}$ to a single fraction and to its lowest terms.

Case VII.

To reduce fractions to other denominations.

Rule.—To reduce quantities from greater denominations to less, multiply the numerator by such numbers as you would multiply by in common reduction, and to reduce quantities from less denominations to a greater, multiply the denominator by such numbers as you would divide by in common reduction. (*g*)

EXAMPLES.

(1) Reduce $\frac{2}{96}$ of a pound to the fraction of a *shilling*.
(2) Reduce $\frac{7}{8}$ of a shilling to the fraction of a *pound*.
(3) Reduce $\frac{5}{9}$ of a pound to the fraction of a *cwt*.
(4) Reduce $\frac{5}{7}$ of a yard to the fraction of an *ell English*.
(5) Reduce $\frac{17}{29}$ of a noble to the fraction of a *crown*.
(6) Reduce $\frac{3}{468}$ of a year to the fraction of a *week*.
(7) Reduce $\frac{7}{9}$ of a guinea to the fraction of a *pound*.
(8) Reduce $\frac{147}{180}$ of a pound to the fraction of a *guinea*.
(9) Reduce $\frac{85}{87}$ of a crown to the fraction of a *noble*.
(10) Reduce $\frac{2}{3}$ of a penny to the fraction of a *crown*; of a *moidore*; and of a *pound*.

(*g*) Because, multiplying the numerator of a fraction by such numbers, is multiplying the fraction, and multiplying the denominator by such numbers, is dividing the fraction.

(1) Reduce $\frac{3}{46}$ of a £ to the fraction of a *shilling*. $\frac{3}{46} \times \frac{20}{1} = \frac{60}{46}$

(2) Reduce $\frac{3}{4}$ of a penny to the fraction of a £. $\frac{3}{4} \times \frac{1}{12} \times \frac{1}{20} = \frac{3}{960}$

(3) Reduce $\frac{3}{4}$ of a guinea to the fraction of a £. $\frac{3}{4} \times \frac{21}{20} = \frac{63}{80}$

(4) Reduce $\frac{2}{3}$ of a £ to the fraction of a *guinea*. $\frac{2}{3} \times \frac{20}{21} = \frac{40}{63}$

Case VIII.

To reduce parts of coin, weight, measure, &c., to vulgar fractions.

Rule.—Reduce the given parts, if need be, to a simple quantity, that is, to the lowest name mentioned, for a numerator; reduce the integer to the same name for a denominator. (*h*)

EXAMPLES.

(1) Reduce 3*s.* 4*d.* to the fraction of a *pound* sterling.
(2) Reduce 7*d.* to the fraction of a *pound.*
(3) Reduce 3*qr.* 7*lb.* to the fraction of a *cwt.*
(4) Reduce 18*s.* $7\frac{1}{4}d.$ to the fraction of a *pound.*
(5) Reduce 4*s.* $6\frac{3}{4}d.$ to the fraction of a *guinea.*
(6) Reduce 3*qr.* 3*nl.* to the fraction of a *yard.*
(7) Reduce 34*gal.* 2*qt.* 1*pt.* to the fraction of a *hogshead* of beer.
(8) Reduce 7*mo.* 2*wk.* 3*d.* to the fraction of a *year.*
(9) Reduce 31*gal.* 1*pt.* to the fraction of a *punch.* of rum.
(10) Reduce $\frac{2}{3}$ of a shilling to the fraction of a *pound;* of a *crown;* and of a *moidore.*

Case IX.

To find the value of a vulgar fraction.

Rule.—Divide the numerator by the denominator; reducing as in compound division. (*i*)

EXAMPLES.

(1) What is the value of $\frac{7}{8}$ of a £?
(2) What is the value of $\frac{17}{21}$ of a *guinea?*
(3) What is the value of $\frac{247}{960}$ of a *pound* sterling?
(4) What is the value of $\frac{13}{28}$ of a *cwt?*
(5) What is the value of $\frac{27}{156}$ of a *ton?*
(6) What is the value of $\frac{4}{34}$ of a *mile?*
(7) What is the value of $\frac{27}{134}$ of a *year?*
(8) What is the value of $\frac{64}{5}$ of a *guinea,* $\frac{3}{5}$ of $\frac{8}{17}$ of a *pound,* and $\frac{7}{27}$ of 1000*l*?

(*h*) To reduce 3*s.* 4*d.* to the fraction of a £; reduce 1*l.* to pence = 240 pence, and 3*s.* 4*d.* is 40 pence or $\frac{40}{240}$ of a pound; 7*s.* is $\frac{7}{20}$ of a pound.

The integer is 1, and is that which the fraction is understood to be a part of.

When you have the given parts expressed in a simple quantity for a numerator, write that number which would reduce it to the denomination of the integer for the denominator.

(*i*) What is the value of $\frac{9}{16}$ of a pound sterling?

$\frac{9}{16}$ of a pound is 9 pounds divided by 16, which done according to the rule of compound division, gives 11*s.* 3*d.*

Case X.

To reduce several fractions to a common denominator.

Rule I.—Multiply each numerator by all the denominators except its own for new numerators; and all the denominators together, for the common denominator. (*k*)

Rule II.—Find the least common multiple of all the denominators of the given fractions, when reduced to their lowest terms, and it will be the least common denominator.

Divide this common denominator by each of the given denominators separately, and multiply the quotients by their several numerators, the products will be the new numerators. (*l*)

EXAMPLES.

(1) Reduce $\frac{2}{3}$, $\frac{3}{4}$, and $\frac{4}{5}$, to a common denominator.
(2) Reduce $\frac{7}{8}$, $\frac{4}{5}$, $\frac{6}{9}$, and $\frac{7}{12}$, to a common denominator.
(3) Reduce $4\frac{1}{7}$, $\frac{5}{16}$, $\frac{8}{9}$, and $\frac{3}{8}$, to a common denominator.
(4) Reduce $1\frac{1}{2}$, and $\frac{2}{3}$, till they have both the same denominator.
(5) Reduce $\frac{2}{3}$, $\frac{5}{9}$, and $\frac{13}{18}$, to a common denominator.
(6) Reduce $4\frac{4}{6}$, $\frac{2}{3}$ of $\frac{3}{4}$, and $\frac{5}{8}$, to a common denominator.
(7) Reduce $5\frac{4}{5}$, $\frac{5}{7}$ of 3, and $14\frac{11}{70}$, to a common denominator.
(8) Reduce $\frac{2}{3}$ of 3, $\frac{7}{8}$ of $1\frac{1}{2}$, and $3\frac{1}{9}$, to a commom denominator.
(9) Reduce $\frac{4}{28}$, $\frac{17}{56}$, and $\frac{124}{224}$, to a common denominator.
(10) Reduce $\frac{2}{3}$ of a *shilling* and $\frac{2}{48}$ of a *pound*, to one denomination, and a common denominator.

(*k*) To reduce fractions to a common denominator, is to change them into other fractions; so that they may have all one and the same denominator.

Example.—Reduce $\frac{2}{3}$, $\frac{5}{6}$, $\frac{7}{9}$, $\frac{3}{4}$, $\frac{1}{4}$, and $\frac{3}{8}$, to a common denominator.

$2\times6\times9\times4\times4\times8=13824$
$5\times3\times9\times4\times4\times8=17280$
$7\times3\times6\times4\times4\times8=16128$
$3\times3\times6\times9\times4\times8=15552$
$1\times3\times6\times9\times4\times8=\ 5184$
$3\times3\times6\times9\times4\times4=\ 7776$

} *the new numerators.*

Then $3\times6\times9\times4\times4\times8=20736$ *the common denominator.*

Hence the new fractions having a common denominator being equal to the given fractions, are $\frac{13824}{20736}=\frac{2}{3}$, $\frac{17280}{20736}=\frac{5}{6}$, $\frac{16128}{20736}=\frac{7}{9}$, $\frac{15552}{20736}=\frac{3}{4}$, $\frac{5184}{20736}=\frac{1}{4}$, and $\frac{7776}{20736}=\frac{3}{8}=$ *Ans.*

Again by Rule II.

(*l*) Taking the same example as before, we find the denominators of the fractions are 3, 6, 9, 4, 4, and 8. Now if one or more of the given denominators be multiples of any of the others, reject those numbers of which they are the multiples; then arrange the remaining numbers in one line, and divide each of them, or the *greater number* of them, by any

QUESTIONS

In all the foregoing Rules in Reduction of Vulgar Fractions.

(1) Reduce $\frac{1680}{2188}$ to its lowest terms.

(2) Reduce $\frac{5\times6\times8}{4\times8\times9}$ to its lowest terms.

(3) Reduce $2\frac{1}{2}$ and $4\frac{1}{3}$ to a common denominator.

(4) Reduce $4\frac{3}{6}$ to an improper fraction, with 84 for its denominator.

(5) Reduce $3\frac{1}{8}$ and $\frac{3}{4}$ of $1\frac{1}{4}$ to a common denominator.

(6) Reduce 15*s.* 9*d.* also $10\frac{1}{2}d.$ to the fraction of a £.

(7) What is the value of $\frac{2}{3}$ of $\frac{4}{5}$ of $\frac{5}{6}$ of a *foot?*

(8) What is the value of $\frac{6}{8}$ of a *noble;* of $\frac{7}{8}$ of a *shilling;* of $\frac{5}{9}$ of a *moidore;* of $\frac{3}{5}$ of a *mark;* and of $\frac{3}{8}$ of a *sovereign?*

(9) Reduce $175\frac{14}{17}$ and $185\frac{7}{25}$.

(10) What is the value of $\frac{39}{5}$ of a *yard?*

(11) Reduce $\frac{12}{16}$ of $\frac{6}{8}$ and $\frac{5}{7}$ of $13\frac{9}{14}$.

(12) Value $\frac{5}{6}$ of a *mile.*

(13) Reduce $\frac{7}{8}$ of an inch to the fraction of a *foot.*

(14) Reduce 3*qr.* 14*lb.* 11*oz.* 14*drs.* to the fraction of a *cwt.*

(15) Reduce $\frac{5}{12}$ to a fraction with 60 for its denominator.

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number that will divide them without a remainder; set the quotients (together with the undivided numbers) in a line underneath; divide this second line as before, and so on till there are no *two* numbers that can be divided. The continued products of the divisors, quotients, and undivided numbers, will give the least common multiple required.

Here the 3, 4, and 4, of the denominators of the fractions, may be cancelled or rejected, because 9 and 8 are multiples of them. Hence,

3)~~3~~, 6, 9, ~~4~~, ~~4~~, 8.

—, 2, 3, —, —, 8.

It will be perceived in this last row of figures, that the 8 is a multiple of 2, which should be cancelled, consequently the least common multiple of the denominators of the given fractions will be $3\times3\times8=72$, which will be the least common denominator.

Then 72 *the least common denominator.*

Divisors	3 | $\overline{24}\times2=48$	*the new numerators.*
	6 | $12\times5=60$	
	9 | $8\times7=56$	
	4 | $18\times3=54$	
	4 | $18\times1=18$	
	8 | $9\times3=27$	

Hence the new fractions in their lowest terms having a common denominator, and also equal to the given fractions, are $\frac{48}{72}=\frac{2}{3}$, $\frac{60}{72}=\frac{5}{6}$, $\frac{56}{72}=\frac{7}{9}$, $\frac{54}{72}=\frac{3}{4}$, $\frac{18}{72}=\frac{1}{4}$, $\frac{27}{72}=\frac{3}{8}=$ *Ans. as before.*

(16) Reduce $16\frac{1}{4}d$; 2*s.* 6*d*; $18\frac{3}{4}d$; and 19*s.* $9\frac{1}{2}d$; to the fraction of a £.

(17) Reduce $\frac{3}{4}$ of a farthing to the fraction of a £; $\frac{1}{3136}$ of a *cwt.* to the fraction of an *oz.*; $\frac{5}{8}$ of a £ to the fraction of a *guinea*; and $\frac{9}{52}$ of a £ to the fraction of a *crown.*

(18) Reduce 1*s.* 8*d*; 2*s.* 6*d*; 3*s.* 4*d*; 5*s*; 7*s.* 6*d*; 12*s.* 6*d*; 13*s.* 4*d*; 15*s*; 17*s.* 6*d*; to the fraction of a £.

(19) Reduce $\frac{3}{4}$ of a mark to the fraction of a *crown.*

(20) Reduce $\frac{4}{5}$ of a crown to the fraction of a *noble.*

(21) Reduce $\frac{5}{8}$ of $\frac{168}{4}$ of $5\frac{5}{12}$; also $\frac{3}{4}$ of $\frac{5}{7}$ of 5*l.* 12*s.*

(22) Reduce $\frac{3}{4}$ of $\frac{4}{5}$ of $\frac{5}{6}$ of 3*yds.* to the fraction of a *foot.*

(23) Reduce $\frac{7}{8}$ of a shilling, and $\frac{7}{21}$ of a £, to a common denominator.

(24) Reduce $\frac{2}{3}$ of $\frac{3}{4}$ of a shilling to the fraction of a £ with 320 for its denominator.

(25) What is the value of $\frac{7}{9}$ of a *moidore?*

(26) Reduce $\frac{588}{84}$; $\frac{512}{64}$; and $\frac{819}{91}$.

(27) What is the worth of $\frac{5}{8}$ of a ship, valued at 1730*l*?

(28) Reduce $\frac{5}{36}$ of a guinea to the fraction of a *crown.*

(29) Reduce $\frac{8}{11}$ of a minute to the fraction of a *day.*

(30) Reduce $\frac{1}{4032}$ of a ton to the fraction of a *lb.*

(31) How much is $\frac{1}{2}$ of $\frac{1}{3}$ of 100*l*; and $\frac{5}{8}$ of $\frac{3}{10}$ of a *noble?*

(32) Reduce $\frac{7}{8}$ of a pole to the fraction of a *league.*

(33) Reduce $\frac{3}{2400}$ of a ton to the fraction of a *pound.*

(34) Reduce $7\frac{1}{2}d.$ to the fraction of half a *crown.*

(35) Reduce 2*s.* $7\frac{1}{2}d.$ to the fraction of half a *guinea.*

(36) Reduce $\frac{5}{8}$ of $154\frac{2}{3}$; and $\frac{3}{7}$ of $944\frac{5}{56}$.

(37) Reduce $3\frac{3}{4}d.$ to the fraction of a *shilling.*

(38) Reduce $\frac{5}{9}$ of a pound to the fraction of a *ton.*

(39) Reduce $\frac{1}{1980}$ of a day to the fraction of a *minute.*

(40) Reduce $\frac{1}{7260}$ of an acre to the fraction of a *yard.*

(41) Reduce 2*s.* $4\frac{4}{5}d.$ also 5*s.* $9\frac{1}{2}d.$ $\frac{5}{6}$, to the fraction of a £.

(42) Reduce $\frac{2}{3}$ of a £ to the fraction of a *crown.*

(43) Reduce $\frac{5}{6}$ of a noble to the fraction of a *mark.*

(44) Reduce 6*s.* $7\frac{1}{2}d.$ to the fraction of a *shilling.*

(45) Reduce $\frac{5}{7}$ of an ell Fl. to *yards.*

(46) Reduce $2\frac{3}{4}d$; 7*s.* 2*d*; 15*l.* 2*s.* $2\frac{1}{2}d.$ to a common denominator.

(47) Reduce $\frac{1}{2}$ of $\frac{2}{3}$ of a moidore to the fraction of a *guinea.*

(48) Reduce $\frac{1}{2}$ of a mark to the fraction of a *noble.*

(49) Find the value of $\frac{5}{12}$ of an ell Eng.; $\frac{6}{13}$ of a furlong; $\frac{6}{7}$ of a puncheon of rum; $\frac{3}{8}$ of a firkin of ale; and $\frac{2}{3}$ of a pipe of wine.

(50) Reduce $\frac{2}{3}$ of a pole to feet, and the fraction of a *mile.*

(51) Reduce $\frac{5}{8}$ of a mark to the fraction of a *sovereign.*

(52) Reduce $6\frac{9}{16}s.$ to the fraction of half a *crown.*

(53) Reduce $2\frac{5}{8}$ half crowns to the fraction of half a *guinea.*

(54) Reduce $\frac{2}{3}$ ell Fr. to *ells Eng.*

(55) Reduce $2\frac{4}{7}$ to a fraction with 73 for its denominator.
(56) Reduce $\frac{4}{7}$ of $5\frac{2}{3}$ to a fraction with 236 for its denominator.

ADDITION OF VULGAR FRACTIONS.

REDUCE compound fractions to single ones, fractions of different denominations to one denomination, and all the fractions to a common denominator.

Add all the numerators together for the numerator of the sum, under which write the common denominator. (*a*)

EXAMPLES.

(1) To $\frac{7}{9}$ add $\frac{3}{9}$; and add $\frac{1}{7}$, $\frac{5}{7}$, $\frac{6}{7}$, and $\frac{3}{7}$.
(2) Add $\frac{4}{16}$, $\frac{17}{16}$, $\frac{5}{16}$, and $\frac{9}{16}$ together; also $\frac{2}{3}$, $\frac{3}{4}$, $\frac{4}{5}$, and $\frac{5}{6}$.
(3) Add $\frac{5}{8}$, $\frac{6}{7}$, and $\frac{4}{9}$ together.
(4) Add $\frac{2}{7}$, $\frac{3}{5}$, of $\frac{5}{6}$, and $\frac{3}{4}$ together; also $\frac{2}{7}$ of $5\frac{1}{2}$, and $\frac{13}{28}$ of 2.
(5) Add $\frac{7}{16}$, $3\frac{7}{9}$, $5\frac{8}{10}$, and $\frac{2}{5}$ of $7\frac{1}{2}$ together.
(6) Add $3\frac{7}{9}l.$, $15\frac{5}{8}l.$, and $7l.$ $12s.$ $9d.$ together *.
(7) Add $\frac{7}{9}$ of a shilling to $\frac{1}{24}$ of a pound.

(*a*) Add $\frac{5}{12}$ and $\frac{3}{12}$ together. Here $\frac{5}{12}+\frac{3}{12}=\frac{8}{12}$ also $\frac{5}{12}$ and $\frac{3}{12}$ of a shilling make 8 pence or $\frac{8}{12}$ of a shilling, wherefore the denominators are not added, as they only serve to express the value or magnitude of the parts, and the numerators express the number of those parts.

And fractions cannot be added till they have a common denominator, any more than things of different signification or value can be added in simple addition. For 3 shillings and 9 pence cannot be added so as to make 12 pence or 12 shillings. Wherefore, if $\frac{2}{3}$, $\frac{3}{4}$, and $\frac{4}{5}$, are to be added together, reduce them to a common denominator, by which they will be made $\frac{40}{60}$, $\frac{45}{60}$, and $\frac{48}{60}$, the sum of which is $\frac{133}{60}$, or $2\frac{13}{60}$.

And $\frac{2}{3}$ of a pound, and $\frac{3}{4}$ of a guinea, cannot be added till they are reduced to one denomination, $\therefore$ $\frac{2}{3}$ of a pound is $\frac{2}{3}\times\frac{20}{21}=\frac{40}{63}$ of a guinea, and $\frac{40}{63}+\frac{3}{4}=\frac{160}{252}+\frac{189}{252}=\frac{349}{252}$ of a guinea. Also, $\frac{3}{4}$ of a guinea is $\frac{3}{4}\times\frac{21}{20}=\frac{63}{80}$ of a pound, and $\frac{63}{80}+\frac{2}{3}=\frac{189}{240}+\frac{160}{240}=\frac{349}{240}$ of a pound. If, therefore, the values of $\frac{349}{252}$ guineas, and $\frac{349}{240}l.$ be found, the result in either case will be $1l.$ $9s.$ $1d.$

* In examples of this nature, it is advisable to adopt the following method :—

Add $3l.$ $12s.$ $6d.$, $5\frac{11}{30}l.$, and $8l.$ $9s.$ $5d.$; reduce $12s.$ $6d.$ and also $9s.$ $5d.$ to the fraction of a pound, and then the sum will be $3\frac{5}{8}+5\frac{11}{30}+8\frac{113}{240}$; this reduced to a common denominator will be $3\frac{150}{240}+5\frac{88}{240}+8\frac{113}{240}$;

(8) To $\frac{5}{6}$ of a crown add $\frac{7}{8}$ of a noble.
(9) To $\frac{9}{16}$ of a foot add $\frac{3}{9}$ of a yard.
(10) To $\frac{7}{8}$ of a mark add $\frac{5}{9}$ of a moidore.
(11) To $\frac{3}{5}$ of a yard add $\frac{1}{2}$ of a foot and $\frac{1}{6}$ of a pole.
(12) To $\frac{2}{9}$ of a firkin add $\frac{8}{13}$ of a kilderkin of beer.
(13) Add $\frac{2}{3}$ of a hhd, $\frac{5}{8}$ of a barrel, $\frac{6}{7}$ of a kilderkin, and $\frac{3}{5}$ of a firkin of ale together.

SUBTRACTION OF VULGAR FRACTIONS.

PREPARE your fractions as directed in addition; take the difference of the numerators for the numerator, under which write the common denominator for the denominator of the fraction required. (*b*)

EXAMPLES.

(1) From $\frac{7}{9}$ take $\frac{3}{9}$, and from $\frac{4}{5}$ take $\frac{4}{9}$.
(2) From $6\frac{1}{9}$ take $5\frac{2}{3}$, and from $2l.$ $13s.$ $6d.$ take $1\frac{5}{8}l.$
(3) From $\frac{247}{346}$ take $\frac{129}{346}$, and from $\frac{7}{8}$ take $\frac{5}{6}$ of $\frac{8}{9}$.
(4) What is the difference between $\frac{5}{9}$ of a guinea and $\frac{7}{8}l.$?
(5) What is the difference between $7l.$ $14s.$ $11d.$ and $15\frac{3}{5}l.$?
(6) What is the difference between $6cwt.$ $1qr.$ $7lb.$ and $4\frac{27}{42}cwt$?

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the sum of the fractional parts is $\frac{351}{240}=1\frac{111}{240}$; therefore carry the 1 to the whole numbers of pounds, and the sum becomes $17\frac{111}{240}l.=17l.$ $9s.$ $3d.$

The same method may be applied to *cwts.* *qrs.* and *lbs.* by reducing the *qrs.* and *lbs.* to the fraction of a *cwt.*, and proceeding as in the above example.

(*b*) From $\frac{9}{16}$ take $\frac{5}{16}$; hence $\frac{9}{16}-\frac{5}{16}=\frac{4}{16}=Ans.$

From $\frac{2}{3}$ take $\frac{3}{8}$. Here $\frac{2}{3}$ and $\frac{3}{8}$ reduced to a common denominator make $\frac{16}{24}$ and $\frac{9}{24}$, then $\frac{16}{24}-\frac{9}{24}=\frac{7}{24}$ the difference required.

If one or both be mixed numbers, you may either reduce them both to improper fractions, or only subtract the fractions, and if you have occasion to borrow, borrow the common denominator, for which carry one to the whole number. As,

$3\frac{2}{5}$ and $1\frac{3}{4}$ reduced to a common denominator, will make $\frac{68}{20}-\frac{35}{20}=\frac{33}{20}=1\frac{13}{20}$, or $3\frac{8}{20}-1\frac{15}{20}=1\frac{13}{20}$, adding 20 the denominator to 8 the numerator, makes 28, then 15 from 28 leaves 13, then I carry 1 to 1, as in the whole numbers.

(7) From $\frac{3}{8}$ of a yard take $\frac{2}{3}$ of a foot.
(8) Subtract $\frac{2}{3}$ of $\frac{3}{4}$ of 6 yards from a pole.
(9) Take $\frac{5}{8}$ of a mark from $\frac{3}{4}$ of $\frac{7}{8}$ of 3*l.* 12*s.*
(10) Take 2 kilderkins from $2\frac{1}{2}$*hhd.* of ale and beer.

MULTIPLICATION OF VULGAR FRACTIONS.

REDUCE mixed numbers to improper fractions.

Multiply the numerators together for the numerator, and the denominators together for the denominator of the product. (*c*)

EXAMPLES.

(1) Multiply $\frac{7}{9}$ by $\frac{3}{4}$; $\frac{1}{2}$ by $\frac{1}{2}$; $\frac{3}{4}$ by $\frac{3}{4}$; $\frac{1}{4}$ by $\frac{1}{4}$.
(2) Multiply $4\frac{5}{8}$ by $\frac{2}{3}$; and $17\frac{4}{5}$ by $6\frac{3}{4}$.
(3) Multiply 7*l.* 15*s.* 6*d.* by $2\frac{5}{6}$; and $\frac{127}{346}$ by $\frac{72}{684}$.
(4) Multiply 3 feet 9 inches by $7\frac{1}{2}$.
(5) Multiply 17 feet 9 inches by 8 feet 6 inches.
(6) Multiply $17\frac{6}{9}$ by $14\frac{5}{8}$, and $\frac{3}{4}$ by $1\frac{1}{3}$.
(7) Multiply $\frac{72}{186}$ by $4\frac{38}{74}$, and $\frac{5}{8}$ of $\frac{16}{21}$ by $\frac{3}{8}$ of $5\frac{1}{2}$.
(8) Multiply $\frac{2}{3}$ of $\frac{3}{4}$ of $\frac{5}{6}$ by $\frac{3}{4}$ of $\frac{7}{8}$.
(9) Multiply 7*s.* 6*d.* by 2*s.* 6*d.*, a pound the integer.
(10) Multiply 12*s.* 6*d.* by 3*s.* 4*d.*, a shilling the integer.

(*c*) Multiply $\frac{7}{8}$ by $\frac{3}{6}$. Here $\frac{7}{8}\times\frac{3}{6}=\frac{21}{48}=\frac{7}{16}$ by the rule.

Multiply $3\frac{2}{3}$ by $2\frac{1}{6}$; reduced to improper fractions will be $\frac{11}{3}\times\frac{13}{6}=\frac{143}{18}=7\frac{17}{18}$.

Multiply $\frac{2}{5}$ of $\frac{7}{8}$ by $\frac{3}{7}$ of $\frac{2}{9}$. Here $\frac{2}{5}\times\frac{7}{8}\times\frac{3}{7}\times\frac{2}{9}=\frac{84}{2520}=\frac{1}{30}$ because compound fractions denote their product, the product of two compound fractions is the continued product of so many single fractions.

Known parts of coin, weights, measures, &c., may be reduced to vulgar fractions, as 7*s.* 4*d.* multiplied by $\frac{3}{4}$, hence 7*s.* 4*d.*$=\frac{11}{30}$*l.* and $\frac{11}{30}\times\frac{3}{4}=\frac{33}{120}$*l.*$=$5*s.* 6*d.*

To multiply a fraction by a whole number, multiply the numerator; but to divide a fraction, multiply the denominator: to multiply a fraction by a fraction, multiply the numerator by the numerator, and the denominator by the denominator.

Multiplying by a fraction less than unity diminishes the multiplicand, 12 multiplied by $\frac{3}{4}$ is $\frac{3}{4}$ of 12$=$9.

DIVISION OF VULGAR FRACTIONS.

When the numerator is put for a denominator, and the denominator for a numerator, the fraction so made is called the reciprocal of the original fraction.

Multiply the dividend by the reciprocal of the divisor, and the product will be the quotient required. (*d*)

EXAMPLES.

(1) Divide $\frac{7}{8}$ by $\frac{2}{3}$, and $\frac{74}{128}$ by $\frac{128}{74}$.
(2) Divide $\frac{3}{4}$ by $\frac{4}{3}$, and $128\frac{3}{4}$ by $3\frac{5}{9}$.
(3) Divide 1 by $2\frac{38}{74}$, and 1 by $\frac{4}{5}$.
(4) Divide 150 feet $10\frac{1}{2}$ inches by 17 feet 9 inches.
(5) Divide 21*l*. 17*s*. 9*d*. by 7*l*. 14*s*. 6*d*.
(6) Divide 21*l*. 17*s*. 9*d*. by $2\frac{5}{6}$; and $\frac{1}{2}$ of $\frac{3}{4}$ by $\frac{2}{3}$ of $\frac{1}{8}$.
(7) Divide $325\frac{19}{23}$ by the sum of $\frac{5}{7}$ and $\frac{3}{8}$ of $16\frac{2}{3}$.
(8) Divide $\frac{96}{125}$ of $\frac{13}{19}$ by the difference of $\frac{7}{18}$ and $15\frac{5}{6}$.
(9) Divide $\frac{1}{6}$ of 3*l*. 12*s*. by $35\frac{15}{19}$.
(10) Divide $160\frac{2}{16}$ by the product of $\frac{16}{18}$ and $\frac{3}{8}$ of $5\frac{1}{6}$.

RULE OF THREE IN VULGAR FRACTIONS.

State the question by the directions given in the rule of three in common arithmetic; multiply, divide, &c., by their respective rules in vulgar fractions.

For this and all the following rules in vulgar fractions differ not from the same rules in simple numbers, but by what is occasioned by the foregoing rules in fractions differing from the same rules in simple arithmetic. (*e*)

(*d*) Divide $\frac{2}{8}$ by $\frac{3}{4}$. Here $\frac{2}{8} \div \frac{3}{4} = \frac{2}{8} \times \frac{4}{3} = \frac{8}{24} = \frac{1}{3} = Ans.$

To multiply by a fraction is to multiply by the numerator and divide by the denominator.—For to multiply by one number and divide by another, is the same as to multiply by the quotient of the former divided by the latter, so $8 \times \frac{12}{3} = (8 \times 12) \div 3 = 8 \times 4 = 32$, and division is just the reverse of multiplication.

Dividing by a fraction less than unity, gives a quotient greater than the dividend, because a less number will be oftener contained in any given number, and 1 gives a quotient equal to the dividend.

To multiply by a fraction is to multiply by the numerator and divide by the denominator, therefore to divide by a fraction is to multiply by the denominator and divide by the numerator.

(*e*) If $\frac{2}{3}$ of a yard cost $\frac{1}{6}$*l*. what will $17\frac{3}{4}$ yards cost? This stated by the directions given in the rule of three in simple arithmetic will stand

EXAMPLES.

(1) If $\frac{3}{4}$ of a shilling buy $\frac{7}{9}$ of a pound, how much may I have for a crown?

(2) If $\frac{7}{9}$ of a yard cost 1*l.* 9*s.* 4*d.*, what will $36\frac{9}{16}$ yards cost?

(3) What length of stuff, which is $1\frac{3}{4}$ inches broad, will cover a square foot?

(4) If I buy $174\frac{2}{3}$ yards of cloth for 43*l.* 13*s.* 4*d.*, how must I sell it per ell English to gain 4*l.* 7*s.* 4*d.* by the whole?

(5) If a man travel $3\frac{2}{3}$ miles every hour, how many miles will he travel in $7\frac{3}{4}$ hours?

(6) If 100*l.* gain 3*l.* 15*s.* interest in $\frac{3}{4}$ of a year, in what time will 33*l.* 6*s.* 8*d.* gain the same interest?

(7) If 100*l.* gain $3\frac{3}{4}$*l.* in $\frac{3}{4}$ of a year, what will it gain in $4\frac{1}{3}$ years?

(8) If 6 men can do a piece of work in $10\frac{3}{4}$ hours, in what time will 15 men do the same?

(9) If 100*l.* gain 1*l.* 5*s.* in a $\frac{1}{4}$ of a year, what will 433*l.* 6*s.* 8*d.* gain in $7\frac{3}{4}$ years?

(10) If $14\frac{3}{4}$*cwt.* be carried $7\frac{1}{2}$ miles for $\frac{7}{8}$*l.*, how far may 34*cwt.* 3*qr.* 14*lb.* be carried for 7*l.* 13*s.* 4*d.*?

(11) If $\frac{2}{3}$ of $\frac{5}{8}$ of 16 bushels of wheat be sufficient for a family of 6 persons $6\frac{1}{2}$ weeks, how much will be sufficient for a family of 21 persons the whole year?

(12) A father left 5 sons, *viz.* A, B, C, D, E, 2000*l.*; of which A was to have $\frac{1}{3}$, B $\frac{1}{4}$, C $\frac{1}{5}$, D $\frac{1}{6}$, and E $\frac{1}{7}$; how much must each have?

After the pupil has worked the foregoing questions in Vulgar Fractions, he may write the answers to the following Examination Questions on the rules and repeat them:—

EXAMINATION QUESTIONS

ON THE RULES OF VULGAR FRACTIONS.

(1) What is a fraction, and what is the difference between a whole number and a vulgar fraction?

(2) Mention all the kinds of fractions.

(3) What is a mixed number?

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thus, as $\frac{2}{3}yd. : \frac{1}{6}l. :: 17\frac{3}{4}yds.$, then the third term reduced to an improper fraction it becomes $\frac{2}{3}yd. : \frac{1}{6}l. :: \frac{71}{4}yd.$; the first and third term multiplied together, and the product divided by the first, or multiplied by its reciprocal, is $\frac{3}{2} \times \frac{1}{6} \times \frac{71}{4} = \frac{213}{48} = \frac{71}{16}l. = 4l.\ 8s.\ 9d.$

(4) What is an improper fraction?
(5) What is a compound fraction?
(6) What is a proper fraction?
(7) Explain the use of the denominators of fractions.
(8) Explain the use of the numerators of fractions.
(9) Can there be any vulgar fractions without a denominator?
(10) In what manner may whole numbers be represented as vulgar fractions?
(11) To what are mixed numbers reduced?
(12) To what are compound fractions reduced?
(13) To what are improper fractions reduced?
(14) Repeat the rules.
(15) How are fractions reduced to a common denominator?
(16) How do you find the value of a vulgar fraction?
(17) How do you reduce parts of coins, &c., to vulgar fractions?
(18) What member of the fraction must be multiplied in reducing quantities from a greater to a less name?
(19) What member of the fraction must be multiplied in reducing from a less name to a greater?
(20) What is meant by the reduction of vulgar fractions?
(21) How is the greatest common measure of two or more fractions found?
(22) In the division of vulgar fractions, is the quotient of the fractions so divided, increased or diminished?
(23) In the multiplication of vulgar fractions, is the product increased or diminished?
(24) What operation is necessary before Addition, Subtraction, Multiplication, and Division, can be performed?
(25) How are fractions added?
(26) Is the same operation necessary in the Multiplication as in the Subtraction of Vulgar Fractions?
(27) In what does the Rule of Three in Vulgar Fractions differ from the Rule of Three in common Arithmetic?
(28) Repeat both rules.
(29) How do you reduce fractions to a given denominator?
(30) In reducing pounds to guineas, and yards to ells, English, French, and Flemish, what members of the fractions are to be multiplied, and by what numbers?
(31) See *Art.* 22 and 23, and say to what kind of fractions is this peculiarity restricted.
(32) In case of *Art.* 8, what kind of fractions are the result? Show why they are so.

PROMISCUOUS QUESTIONS.

(1) What number added to $\frac{14}{27}$ will make $1\frac{3}{5}$?
(2) What number subtracted from $1\frac{7}{8}$ will leave $\frac{7}{29}$?

(3) What number multiplied by $\frac{3}{4}$ will produce $\frac{5}{6}$?
(4) What number divided by $\frac{5}{6}$ will give $\frac{5}{8}$?
(5) What is the sum, difference, product, and quotient of $\frac{96}{252}$ and $\frac{42}{120}$?
(6) If I buy cloth at 3*s*. $4\frac{5}{8}$*d*. per yard, and sell again $\frac{2}{3}$ of a yard for 2*s*. 10*d*., what do I gain per cent?
(7) If $\frac{3}{8}$ of a ship cost 1500*l*, what is the value of $\frac{9}{16}$ of that ship?
(8) A, B, and C, trade together; A advanced $\frac{1}{3}$ of the stock, B $\frac{2}{5}$, and C the rest; they gained 140*l*; what is each man's share of the gain?
(9) Write down 4 threes to make 14, 34, and 111 respectively.
(10) If I buy $\frac{7}{9}$ of a yard for $16\frac{5}{8}$*s*, and sell it again for $18\frac{3}{9}$*s*, what do I gain per cent?
(11) If I buy cloth at $3\frac{7}{8}$*s*. per ell Flemish, how must I sell it per ell English, to gain $17\frac{3}{8}$*l*. per cent?
(12) Subtract $\frac{2}{3}$ of $\frac{5}{8}$ from $\frac{5}{8}$.
(13) How many pair of hose at $3\frac{2}{7}$*s*. per pair, must be given for $17\frac{3}{5}$ yards of cloth at $7\frac{1}{7}$*s*. per yard?
(14) How much Irish money must be given for $375\frac{7}{8}$*l*. English, exchange $1\frac{1}{12}$*l*. per pound sterling?
(15) A person bought $\frac{3}{8}$ of a ship for $275\frac{1}{4}$*l*, what must he sell $\frac{1}{6}$ of a share for, to gain 20*l*. per cent?
(16) When a staff, 3 feet in length, standing upright upon the ground, gives a shadow of $4\frac{7}{8}$ feet in length, how high is that tower which gives a shadow $32\frac{3}{4}$ yards in length?
(17) If a man by trading gain $17\frac{2}{3}$*l*. per cent, what does he gain per pound?
(18) Four men bought $\frac{3}{4}$ of a lottery ticket for 12*l*. 15*s*. which came up a prize of 1000*l*; what is each man's share thereof?

DECIMAL FRACTIONS.

A DECIMAL fraction has no denominator written to it, it being always an unit with as many ciphers annexed as there are

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Decimals are tenths, &c. The value of each figure in a decimal is ten times less than the preceding decimal figure, in calculating from the left to the right hand; thus, ·2 is $\frac{2}{10}$, ·02 is $\frac{2}{100}$, ·003 is $\frac{3}{1000}$; also ·37 is read three-tenths seven hundredth parts; and ·265 is read two-tenths six hundredth five thousandth parts, and so on.

Because decimals increase their value from the right to the left hand, and decrease from the left to the right hand, in the same tenfold proportion as integers or whole numbers, they may be annexed to whole numbers, and worked in all respects as whole numbers.

If ciphers be added to the right of a decimal, its value will not be altered in any degree; for ·2 or $\frac{2}{10}$, ·30 or $\frac{3}{300}$, ·400 or $\frac{4}{1000}$ are each respectively equal to each other.

figures in the given decimal or numerator.—Decimals have a point or comma put before them to distinguish them from integers: so $\frac{5}{10}$ is written thus ·5; $\frac{25}{100}$ thus ·25; $\frac{725}{1000}$ thus ·725.

Decimal fractions suppose unity to be divided in ten equal parts, called tenths, each of these into ten more, called hundredths, &c., as in the following

TABLE.

Tenths	5
Hundredths	6
Thousandths	7
Ten Thousandth	8
Hundred Thousandth	9
Millionth	3
Ten Millionth	4

Read the following,

·54
·045
·0067
·60467
·85649
·967504

REDUCTION OF DECIMALS.

By Reduction, we change vulgar fractions and the less parts of coin, weight, measure, &c., into decimals, and find the value of any decimal given.

To reduce a vulgar fraction to a decimal.

RULE.

Annex a competent number of ciphers to the numerator, and divide by the denominator; the quotient will be the decimal required. Only take care that there may be as many figures in the quotient as you have taken ciphers to produce them. (*a*)

(*a*) Reduce $\frac{3}{8}$ to a decimal.

$$\frac{3}{8} = \frac{3{\cdot}000}{8} = {\cdot}375.$$

The number of ciphers annexed to the numerator of the fraction consists in this case of three ciphers; hence there must be three decimal places in the answer.

Reduce $\frac{14}{32}$ to a decimal.

As the denominator is to its numerator, so is unity with a competent

EXAMPLES.

(1) Reduce $\frac{13}{16}$ to a decimal.
(2) Reduce $\frac{7}{256}$ and $\frac{8}{2038}$ to decimals.
(3) Reduce $\frac{1}{2}$, $\frac{2}{3}$, $\frac{3}{4}$, $\frac{4}{5}$, $\frac{5}{6}$, $\frac{6}{7}$, $\frac{8}{9}$, $\frac{9}{10}$, to decimals.
(4) Reduce $\frac{1}{9}$, $\frac{3}{9}$, $\frac{7}{9}$, $\frac{12}{33}$, $\frac{162}{999}$, $\frac{28}{333}$, to decimals.
(5) Reduce $\frac{27}{346}$, $\frac{8}{512}$, $\frac{7}{2048}$, and $\frac{6}{4096}$, to decimals.

To reduce the less parts of coin, weight, measure, &c., to decimals.

RULE.

Reduce the given parts to a simple quantity, by reducing them to the lowest name mentioned, annex ciphers thereto, and divide by such number as will reduce them to the name required, the quotient will be the decimal required.

Or reduce the given parts to a vulgar fraction, and that fraction to a decimal. (*b*)

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number of ciphers annexed to the decimal required. Now, if the required decimal have four figures, its denominator will be understood to be 1·0000.

$\therefore 32 : 14 :: 1{\cdot}0000 : {\cdot}4375$, $\therefore \frac{14}{32} = \frac{{\cdot}4375}{1{\cdot}0000} = {\cdot}4375$; this is only annexing four ciphers to 14, and dividing by 32, thus $\frac{14}{32} = \frac{14{\cdot}0000}{32} = {\cdot}4375$.

Hence the rule. It will be expedient to put a point before the annexed ciphers in the dividend, to prevent mistakes in ascertaining their number.

If the number of figures in the quotient be less than the number of ciphers which were added to produce the decimal, we must prefix ciphers to the quotient to make it equal to as many ciphers as were taken; thus $\frac{4}{625} = \frac{4{\cdot}0000}{625} = {\cdot}0064$.

Sometimes the decimal will go on without ever coming to an end, the same figure or figures recurring in the same order; such decimals are called repetends, or circulating decimals, as $\frac{2}{3} = {\cdot}6'666$, &c., and $\frac{4}{33} = {\cdot}1'2'12$, &c.

As the exact value of such vulgar fractions as $\frac{2}{3}$ and $\frac{4}{33}$ cannot be represented, yet by increasing the number of decimal places we may approximate very near the truth.

To change any given decimal to a vulgar fraction, write the figures of the given decimal for a numerator, and 1 with as many ciphers annexed for a denominator; thus, ${\cdot}5 = \frac{5}{10}$; ${\cdot}25 = \frac{25}{100}$; ${\cdot}125 = \frac{125}{1000}$

If the decimal be a repetend or circulating decimal, write as many nines for the denominator as there are figures in the numerator; thus, $3' = \frac{3}{9}$, and ${\cdot}2'3' = \frac{23}{99}$, and ${\cdot}7'46' = \frac{746}{999}$

(*b*) Reduce 3*d.* to the decimal of a shilling.

By annexing ciphers to 3, and dividing by the number of pence

EXAMPLES.

(1) Reduce 17*s.* to the decimal of a pound.
(2) Reduce 7*d.* to the decimal of a shilling.
(3) Reduce 10½*d.* to the decimal of a shilling.
(4) Reduce 13*s.* 9*d.* to the decimal of a pound.
(5) Reduce 3*qr.* 7*lb.* to the decimal of a *cwt.*
(6) Reduce 3*qr.* 3*nl.* to the decimal of a yard.
(7) Reduce 17*s.* to the decimal of a guinea.
(8) Reduce 2 roods 17 perches to the decimal of an acre.
(9) Reduce 5*s.* 10½*d.* to the decimal of a pound.
(10) Reduce 7½*d.* to the decimal of a pound.
(11) Reduce 6*s.* 8*d.* to the decimal of a pound.
(12) Reduce 2 feet 9 inches to the decimal of a yard.
(13) Reduce 6*fur.* 28*per.* 2*yds.* 1*ft.* to the decimal of a mile.
(14) Reduce 3 months, 2 weeks, 4 days, to the decimal of a year.
(15) Reduce ⅔ of an inch to the decimal of a yard.
(16) Reduce 3 quarts 1 pint to the decimal of a hogshead.
(17) Reduce 4*oz.* 8*drs.* to the decimal of a *cwt.*
(18) Reduce 2*dwt.* 16*grs.* to the decimal of a pound troy.
(19) Reduce 3*s.* 4*d.* to the decimal of a mark.

Divide the least name by such number as will reduce it to the next greater; to the decimal so obtained, prefix the given number of the same name, then divide by such number as will reduce it to the next greater, always annexing ciphers to the dividend as occasion may require; thus proceed till it be reduced to the decimal of the required integer. (*c*)

(20) Reduce 19*s.* 11¾*d.*; 5*s.* 7½*d.*; 9¼*d.*; 11*s.* 10½*d.*; 14*s.* 9¾*d.*;

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12)3·00 in a shilling, the quotient will be the decimal of a shilling. Or, three pence is $\frac{3}{12}$ of a shilling, and $\frac{3}{12}$ reduced to a decimal is ·25*s.*
·25*s.*

What decimal of a pound is 1*s.* 6½*d.*?

$$1s.\ 6\tfrac{1}{2}d. = \frac{74}{960} = \cdot 770833.$$

Every ½ is ·5; ¼ is ·25; ¾ is ·75; ⅛ is ·125; 2*s.* is ·1; 1*s.* is ·05; 6*d.* is ·025; 3*d.* is ·0125; and every farthing is ·00104 of a pound: and *vice versa.*

(*c*) Reduce 13*s.* 4¾*d.* to the decimal of a £.

4)3·00
——
12)4·75
——
20)13·3958333, &c.
——
·669791666, &c.

First, ¾ reduced to the decimal of a penny is ·75, then 4¾ or 4·75 reduced to the decimal of a shilling is ·3958333, &c., and 13*s.* 4¾*d.* reduced to the decimal of a pound is ·669791666, &c.

$11\frac{3}{4}d.$; $10d.$; $1d.$; $2\frac{1}{4}d.$; $3d.$; $\frac{1}{2}d.$; $6\frac{3}{4}d.$; $\frac{1}{4}d.$; and $17s.\ 0\frac{1}{2}d.$; to the decimal of a pound.

To find the value of any given decimal.

RULE.

Multiply to reduce it to the next lowest denomination, as in common reduction; cut off as many figures for decimals in the product as there are in the given decimal, the rest will be whole numbers; reduce the decimal so cut off to the next lower name, and cut off as before; thus proceed till you have brought it to its lowest terms.—The parts signified will be cut off from the decimals. (*d*)

EXAMPLES.

(1) What is the value of ·32875 of a pound sterling?
(2) What is the value of ·01275*l.* and ·00625*l*?
(3) What is the value of ·2735 of a guinea?
(4) What is the value of ·0735 of a ton?
(5) What is the value of ·3675 and ·625 of a yard?
(6) What is the value of ·2674 of an acre?
(7) What is the value of ·2375 of a *hhd.* of ale or beer?
(8) What is the value of ·7245 of a year?
(9) What is the value of ·37865 of a *hhd.* of wine?
(10) Reduce $\frac{3}{4}$ of $\frac{4}{5}$ of a *cwt.* to a decimal, and find its value.
(11) What is the value of ·7936 of a moidore?
(12) What is the value of ·2675 of a guinea?
(13) What is the value of ·03756 of a century or 100 years?
(14) What is the value of ·3275 of a bushel?
(15) What is the value of ·9673 of a pound troy?

To find the decimal of a £ by inspection.

RULE.

Double the tenth's figure for shillings, and reckon the two next figures for farthings; if the second figure be 5, or more,

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(*d*) The integer is that of which the decimal is a part. Find the value of ·7365*l.*

·7365
20
14·7300
12
8·7600
4
3·0400

First, ·7365*l.* = 14·73 shillings, ·7300*s.* = 8·76 pence, and ·76*d.* = 3·04 farthings ∴ the value required is 14*s.* $8\frac{3}{4}d.$

reckon the shillings one more, and take the remainder as in the first part.

Observe, that if the two second figures be 25, deduct one farthing; if 38, deduct one farthing; and if 41, or upwards, deduct a half-penny.

EXAMPLES.

(1) Reduce ·625 to the decimal of a £.
(2) Reduce ·897 to the decimal of a £.
(3) What decimal of a £ is ·675?
(4) Reduce ·784 to the decimal of a £.
(5) What decimal of a £ is ·937?
(6) What decimal of a £ is ·427?

ADDITION OF DECIMALS.

REDUCE vulgar fractions, and the less parts of coin, weight, measure, &c., to decimals, and all the numbers to one denomination.

Write units under units, tens under tens, &c., in integers, tenths under tenths, hundredths under hundredths, &c., in decimal parts, so will the separating or distinguishing points stand directly under one another.

Add the whole as integers or whole numbers.

Put the separating point directly under the others, so the sum will have as many decimal figures as any of the numbers given to be added, that is, equal to that which has the greatest number. (*e*)

EXAMPLES.

(1) Add 127·35, 24·675, 8·34, 287·3, and 4·625, together.
(2) What is the sum of $24\frac{2}{3}$, $17\frac{3}{4}$, 8·3765, and $147\frac{3}{8}$?

(*e*) Add 27*l.* 13*s.* 6*d*; 8·2375*l*; $3\frac{13}{16}l$; and ·2375*l.* together.

27*l.* 13*s.* 6*d.* = 27·6750
8·2375
$3\frac{13}{16}l.$ = 3·8125
·2375
39*l.* 19*s.* 3*d.* = 39·9625*l.*

The fractions and other parts reduced to decimals, write them under one another, so that the points all fall under one another, so will like parts stand under like parts; add the whole as integers. Put the point under the point, so there are four figures of decimals in the sum; which is the greatest number of decimal figures in any one of the numbers to be added; the sum is 39·9625*l*, the value of which, found by the rules in reduction, is 39*l.* 19*s.* 3*d*, as in the example.

If any of the decimals be repetends, continue them beyond the others,

(3) What is the sum of $2{\cdot}3725l$, $16{\cdot}375l$, $4\frac{9}{16}l$, and $2l.\ 17s.\ 8\frac{1}{2}d$?
(4) What is the sum of $37{\cdot}568$, $9{\cdot}367$, $\cdot4285$, $\cdot07364$, $42{\cdot}75$, $123{\cdot}4$, $387{\cdot}56$, $42{\cdot}3$, $327{\cdot}$, and $46\frac{9}{16}$?
(5) What is the sum of $37cwt.\ 3qr.\ 14lb$, $7{\cdot}2735cwt$, $6\frac{13}{16}cwt$, $47{\cdot}32cwt$, $32\frac{5}{8}cwt$, and $27\frac{19}{32}cwt$?
(6) What is the sum of $37{\cdot}426l$, $18{\cdot}375$ guineas, $17l.\ 19s.\ 6d$, $347{\cdot}65$ shillings, and $17\frac{35}{64}l$?
(7) What is the sum of $7{\cdot}375$, $4\frac{7}{9}$, $3\frac{5}{8}$, $6\frac{2}{3}$, $7\frac{5}{6}$, $24{\cdot}376$, $38{\cdot}59$, $16\frac{1}{3}$, and $30\frac{8}{9}$?
(8) What is the sum of $\frac{2}{3}$, $\frac{7}{9}$, $\frac{5}{6}$, $\frac{18}{33}$, $\frac{37}{99}$, $\frac{460}{999}$, and $\cdot05926$?
(9) What is the sum of $14cwt.\ 3qr.\ 7lb$, and $7{\cdot}235cwt$, $20\frac{17}{28}$, $30{\cdot}3765cwt$, $5cwt.\ 1qr.\ 20lb$, and $23{\cdot}705cwt$?
(10) What is the sum of $\frac{3}{4}$, $\frac{2}{3}$, $\frac{7}{9}$, $\frac{20}{33}$, $\frac{74}{99}$, $\frac{128}{333}$, and $\cdot63967$?

SUBTRACTION OF DECIMALS.

Prepare your numbers as directed in addition, write the separating points one under the other, so that parts may stand under like parts; subtract as in whole numbers; then write the separating point under the others, *viz.* cut off as many figures

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and make them end together; then, in adding, increase the sum of the first column by as many units as there are nines therein, as

$\frac{3}{4} = \cdot7500'$
$\frac{6}{9} = \cdot6666'$
$\frac{8}{9} = \cdot8888'$
$\frac{7}{8} = \cdot8750'$
$\frac{4}{9} = \cdot4444'$

$8\frac{5}{8} = 3{\cdot}6250'$

The repetends continued beyond the other and ending together, the first sum 18 contains two nines, therefore 2 added to 18 makes 20, the rest of the work is the same as usual in others; the repetend is 0, so that the sum is finite, the truth of which may be proved by working the same example by the rule in vulgar fractions.

If some of the decimals be repetends and others circulates, continue them both beyond those that are finite, and till their periods end together, then to the sum of the first column add as many as would arise to carry to it, if they were continued farther; so will you get a circulate in the sum.

$2\frac{1}{2} = 2{\cdot}50'00000'..00$
$3\frac{1}{6} = 3\ 66'66666'..66$
$7\frac{23}{33} = 7\ 69'69696'..96$
$14\frac{248}{666} = 14{\cdot}37'23723'..72$

$Sum = 28\frac{5187}{21978} = 28{\cdot}23'60087'..36$

Here the repetend of 6, the circulates of $\cdot69$ and $\cdot372$ continued till the periods finish together, if they were continued farther, it may easily be observed that there would be 2 to carry to this first column, that the sum is $28{\cdot}23'60087'$, and taking away the $\cdot5$, which is the finite part, there will be left $\cdot73'60087'$ for the circulate.

for decimals in the remainder, as there are in either of the numbers to be subtracted. (*f*)

EXAMPLES.

(1) Subtract 37·45 from 374·5, and 3·745 from 3745.
(2) Subtract 0·375 from 10, and ·0056 from 190·05.
(3) Subtract 24·32735 from 124·336.
(4) Subtract 78·467 from 327·3151.
(5) From 300·97046 subtract 29·3978.
(6) From 11·375*l.* subtract 3*l.* 17*s.* 10½*d.*
(7) Subtract 17·375*cwt.* from 23*cwt.* 3*qr.* 14*lb.*
(8) Subtract 27*hhd.* 32*gal.* 1*qt.* from 143·375*hhd.* of wine.
(9) What is the difference between 17·375 and 8·9465?
(10) Subtract 12·375 guineas from 16·275*l.*
(11) Required the difference between $\frac{5}{6}$ and $\frac{4}{9}$ decimally.
(12) What is the difference between $\frac{5}{6}$ and $\frac{36}{333}$ added to ·0623?
(13) Subtract $1\frac{17}{33}$ from 3*l.* 13*s.* 4*d.* and ·0263 from 5*s.* 4½*d.*
(14) Subtract $\frac{2}{3}$ of a pound from $\frac{3}{4}$ of a guinea.
(15) Subtract 7 feet 10 inches from 16 feet 4 inches.

MULTIPLICATION OF DECIMALS.

REDUCE vulgar fractions and the less parts of coin, weight, measure, &c., to decimals.

Multiply as in whole numbers, and cut off as many figures for

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(*f*) Subtract 64·325 from 973·2367.

973·2367
64·3250
908·9117

$\frac{5}{6} = ·83'33$
$\frac{2}{3} = ·66'66$
$\frac{1}{6} = ·16'66$
$\frac{3}{4} = ·750'0'$
$\frac{23}{99} = ·232'3'$
$\frac{205}{396} = ·517'6'$
$1\frac{2}{3} = 1·666'$
$\frac{834}{999} = ·834'$
$\frac{831}{999} = ·831'$

If the less be a repetend, continue it beyond the other, and borrow 9 instead of 10 at the first figure; if it is a circulate, do the same. If both be single repetends, make them end together, and if there be occasion to borrow at the first figure, borrow 9 only, instead of 10.

If both the circulates, or one repetend and the other a circulate, continue both till their periods end together, and if there would be occasion to borrow at the following figure were they continued that figure farther, carry 1 to the first figure.

If the numbers be in different denominations, reduce them till they be alike.

decimals in the product as there are in both factors together, *viz.* as there are in both multiplicand and multiplier. (*g*)

EXAMPLES.

(1) Multiply 374·65 by 27·35, and 13·465 by ·3745.
(2) Multiply ·7854 by ·4628, and ·12376 by ·1235.
(3) Multiply ·23746 by ·01795, and ·02837 by ·04695.
(4) Multiply 27·128 by $13\frac{3}{4}$, and 14*l.* 17*s.* 6*d.* by 34·275.
(5) Multiply 7*l.* 6*s.* 9*d.* by $17\frac{5}{8}$, and 3*l.* 14*s.* 9*d.* by ·375.
(6) Multiply 9 feet 9 inches by 3 feet 6 inches.
(7) Multiply 17*cwt.* 1*qr.* 21*lb.* by 6·375.
(8) Multiply 7*s.* 6*d.* by 2*s.* 6*d.* a pound the integer.*
(9) Multiply 7*s.* 6*d.* by 2*s.* 6*d.* a shilling the integer.
(10) Multiply 2*l.* 16*s.* 8*d.* by ·5.
(11) Multiply 7*l.* 13*s.* 4*d.* by 7·35.

(*g*) 2·734 multiplied by 4·35 in all respects as whole numbers gives 11·89290 in the product, and because there are three decimal figures in one factor, and two in the other, *viz.* 5 in both, there must be 5 decimal figures in the product, so the true product is 11·89290. When there are not so many figures in the product as there should be decimals, ciphers must be added to the left hand, so ·125 multiplied by ·12 gives ·1500, and because there should be 5 decimal figures, I prefix one cipher, thus ·01500, which makes it the true product.

To multiply a repetend by a single figure, add 1 to the first product for every 9 therein, so will you have a repetend in the product; and if there be several figures in the multiplier, do so with each product, and continue them till they end together, then add them as so many repetends.

If the multiplicand be a circulate, consider the increase that would arise to the first product, if the multiplicand was continued farther. Thus do with each product, make them end together, then add them by the rule for adding circulates.

If the multiplier be a repetend, multiply thereby as usual and divide by 9, till you have as many figures in the quotient as there are in the product, then the quotient will be the true product. Or, instead of dividing by 9, write the product under itself, but removed one figure towards the right hand as oft as there are figures in the product, then the sum will be the product, exhibiting the repetend. If the multiplier be a circulate, divide the product produced thereby by as many nines as there are figures in the circulate, or write the product under itself as many figures removed to the right hand as are in the circulate continually, till the last figure be carried beyond the first, then the sum will be the true product exhibiting the circulate.—If both factors be repetends or circulates, both rules must be united.

* Money multiplied by money, if a shilling be the integer, the factors must be expressed in shillings and the decimal of a shilling. But if a pound be the integer, the factors must be expressed in pounds and the decimals of a pound, and so for any other integer.

(12) Multiply $476\frac{2}{3}$ by 14·25.
(13) Multiply 17 feet 8 inches by $10\frac{1}{2}$ inches.
(14) Multiply 27 feet 10 inches by 16 feet 9 inches.
(15) Multiply 16 feet $10\frac{1}{2}$ inches by 3 feet 8 inches.
(16) Multiply 34 feet 9 inches by 7 feet 10 inches.
(17) Multiply 20 feet 8 inches by 13 feet 4 inches.
(18) Multiply 15*l*. 15*s*. by $\frac{3}{4}d$. by 15*s*. and by 15*l*.

DIVISION OF DECIMALS.

PREPARE your decimals as directed for multiplication, divide as in whole numbers, cut off as many figures for decimals in the quotient as the number in the dividend exceeds the number in the divisor, *viz*. make the number of decimal figures in the divisor and quotient together equal to the number in the dividend. (*h*)

EXAMPLES.

(1) Divide 1024·6775 by 27·35, and 27·35 by ·125.
(2) Divide ·1 by ·125, and 3·7265 by 2784·25.
(3) Divide 1*l*. 8*s*. $0\frac{3}{8}d$. by ·375, and 35*l*. 6*s*. 8*d*. by 36·4.
(4) Divide 236 feet $11\frac{1}{4}$ inches by 27 feet $10\frac{1}{2}$ inches.
(5) Divide 5*s*. 3*d*. by 2*s*. 6*d*. a shilling the integer.
(6) Divide $3\frac{3}{4}d$. by 2*s*. 6*d*. a pound the integer.
(7) Divide 24*l*. 15*s*. by $5\frac{5}{8}$, and 3·7456 by 1·5623.

(*h*) To divide **173·5425** by **3·75**, the work performed as in whole numbers thus, **3·75)173·54250(46·278**, because there are five decimal figures in the dividend and two in the divisor, their difference is three, to be cut off for decimals in the quotient, then three in the quotient with two in the divisor is equal to five, the number in the dividend.

Thus you may take additional ciphers to the dividend at pleasure, taking care to reckon the number taken in dividing as decimals in the dividend.—If you put the decimal point in the quotient at any part of the operation, continuing the operation afterwards will not cause the point to be removed.

If there be not so many figures in the quotient as there should be decimals, prefix ciphers to make the number; thus, **247·5)1·4850(·006.**

If there be not as many decimal figures in the dividend as in the divisor, you may annex a sufficient number of ciphers, and if there be not a remainder, you must add ciphers in the quotient till you have taken as many in the dividend as will make the decimal figures therein equal to those in the divisor, as **2·476)14856·000(600.**

If both divisor and dividend be repetends or circulates, with an equal number of figures, their quotient, obtained by the common method, will be true, $\frac{2}{3} \div \frac{13}{99} = \frac{66}{99} \div \frac{13}{99} = 66 \div 13$.

(8) Divide 274*l.* 16*s.* 6*d.* by 2·5, $\frac{3}{4}$, $\frac{5}{8}$, and by $17\frac{1}{2}d.$
(9) Divide 18*l.* 17*s.* 3*d.* by $7\frac{2}{3}$, $15\frac{5}{6}$, and $27\frac{6}{9}$.
(10) Divide 274 feet 8 inches by 7 feet 9 inches.
(11) Divide 27 feet 9 inches by 9 inches and by 3 inches.
(12) Divide 3*l.* 15*s.* by 15*s*, 15*d*, 15*l*, and by $\frac{3}{4}d.$
(13) Divide 2000 by ·2000, and by ·0002.

RULE OF THREE IN DECIMALS.

REDUCE the fractional parts to decimals.—State the question by the directions given in the common rule of three.—Multiply and divide by those respective rules in decimals, the quotient will be the answer, the decimal part of which may be valued by the rule in reduction; for there is no further difference between this and the common rule of three, than what is occasioned by the foregoing rules in decimals. (*i*)

EXAMPLES.

(1) If $7\frac{1}{2}$ yards cost 3·25*l*, what will $47\frac{5}{8}$ yards cost?
(2) If $\frac{3}{5}$ of a shilling buy $\frac{7}{8}lb$, how much may I have for 5*s*?
(3) How much stuff, $\frac{3}{4}$ yard broad, will line $7\frac{3}{4}$ yards of cloth which is $\frac{7}{8}$ yard broad?
(4) If 100*l.* gain 4*l.* 17*s.* 6*d.* interest in 12 months, what will the same principal gain in $7\frac{3}{4}$ months?
(5) In what time will 247·35*l.* gain as much interest as 947*l.* 17*s.* will gain in 12 months?
(6) If $\frac{2}{3}$ of a shilling buy $\frac{7}{9}$ of a pound, how many ounces may I have for 7*s.* 4*d*?
(7) If 45*l.* gain 2·25*l.* interest in 12 months, what will 478*l.* 15*s.* 6*d.* gain in the same time?
(8) If 100*l.* gain 4*l.* 10*s.* interest in one year, what will 1*l.* gain in the same time?
(9) How far will a man travel in $7\frac{3}{4}$ days, who travels 754 miles in 24 days?
(10) If 1 Spanish piece of eight be worth 4*s.* $7\frac{5}{8}d.$ what is the worth of $276\frac{3}{8}$ such pieces?
(11) If 100*l.* gain $4\frac{7}{8}l.$ in one year, what will 784*l.* 13*s.* 6*d.* gain in $7\frac{3}{4}$ years?
(12) What sum of money will gain 27*l.* 15*s.* in $3\frac{3}{4}$ years, when 100*l.* will gain $4\frac{7}{8}l.$ in one year?

(*i*) If $7\frac{1}{4}$ yards of cloth cost 3*l.* 12*s.* 6*d*, what will $12\frac{1}{2}$ yards cost?
If $7\frac{1}{4}yds.$: 3*l.* 12*s.* 6*d.* :: $12\frac{1}{2}yds.$ or 7·25*yds.* : 3·625*l.* :: 12·5*yds.*

$$\div \frac{3\cdot625 \times 12\cdot5}{7\cdot25} = \frac{45\cdot3125}{7\cdot25} = 6\cdot25l. = 6l.\ 5s.$$

(13) If an acre of land be 220 yards long, and 22 yards broad, how many acres are in that piece which is $784\frac{1}{2}$ yards long and $236\frac{3}{4}$ yards broad?

(14) If $46\frac{3}{4}$*cwt.* be carried 45·5 miles for 3*l.* 10*s.*, how far may 27·375*cwt.* be carried for the same money?

(15) If $46\frac{3}{4}$*cwt.* be carried $45\frac{1}{2}$ miles for 3*l.* 10*s.*, how much must be paid for the carriage of 95·325*cwt.* the same journey?

PROMISCUOUS QUESTIONS.

(1) What must I multiply 8 by, to give 1 in the product?

(2) What must I divide 1 by, to give 4 in the quotient?

(3) What number must be subtracted from $43\frac{1}{2}$, to leave 17·3695 for the remainder?

(4) What number must be added to 34·75, that the sum may be 37·6285?

(5) What number must be multiplied by $3\frac{7}{8}$, and the product divided by 7·365, to give $8\frac{3}{4}$ in the quotient?

(6) What number must I multiply by, to produce the same number as if I had multiplied by 3, and divided by 4?

(7) What will 27·375 yards come to, at 7*s.* $10\frac{1}{2}$*d.*, *per yard?*

(8) Two men set out at the same time from the same place and travel the same road, one goes at the rate of $3\frac{3}{4}$ miles *per hour*, and the other $3\frac{2}{3}$ miles *per hour;* how far will they be asunder at the end of $14\frac{1}{2}$ hours, and how long must they travel before they be 20 miles asunder?

(9) A grocer bought 46*cwt.* 3*qr.* 14*lb.* of sugar at 2*l.* 16*s.* *per cwt.*, and 38*cwt.* 1*qr.* 7*lb.* at 2*l.* 4*s.* *per cwt*, which he mixed together, and sold at $7\frac{3}{4}$*d.* *per lb*, what did he gain or lose by the whole?

(10) If a board be $10\frac{1}{2}$ inches broad, what length must I take thereof to be equal to another board which is 12 inches broad and $7\frac{3}{4}$ feet long?

(11) If I buy 46 yards of cloth for 17*l.* 17*s.* 6*d.*, what must I sell it for per yard to gain $18\frac{1}{2}$*l.* *per cent?*

(12) How many hats, at 3*s.* $7\frac{1}{2}$*d.* each, must be given for $46\frac{3}{4}$ yards of cloth at 7*s.* 9*d.* *per yard?*

(13) A, B, and C, trade together; A advances 40*l.* 15*s*, B 54*l.* 10*s*, and C 62*l.* 16*s*, which gained 39*l.* 10*s.* 3*d*; what did they gain *per cent*, what *per pound*, and what is each man's share?

(14) If I buy cloth at 6*s.* 3*d.* *per yard*, how must I sell it *per yard* to gain 15*l.* *per cent?*

(15) A bankrupt makes a dividend of 68*l.* *per cent*, what is it *per pound?*

SIMPLE INTEREST BY DECIMALS.

When interest is not allowed for interest unpaid, it is called simple interest.

Principal is the money lent, and amount is the sum of both principal and interest.

Interest is the money paid for the loan of money.

Time is the number of years, and parts of a year, for which interest is allowed.

Rate is the interest of 100*l.* for one year, which divided by 100 gives the interest of 1*l.* for one year, the rate to be used in simple interest by decimals.

Case I.

To find the interest or amount of any sum for any number of years.

Rule.—Multiply the principal by the rate, and that product by the time for the interest.

To find the amount, add 1 to the product of the rate and time, and multiply the principal by the sum.

EXAMPLES.

Required the interest of 64*l.* 10*s.* for $4\frac{1}{2}$ years, at 5*l. per cent, per annum.*

First, $5 \div 100 = \cdot 05$ *per pound;* then *as* 1*l.* : ·05 :: 64·5*l.* : 3·225*l.* the interest for one year; and $3 \cdot 225 \times 4 \cdot 5 = 14 \cdot 5125$*l.*, or 14*l.* 10*s.* 3*d.* the interest for $4\frac{1}{2}$ years.

Required the amount of 64*l.* 10*s.* for $4\frac{1}{2}$ years, at 5*l. per cent, per annum.*

First, $\cdot 05 \times 4 \cdot 5 = \cdot 225$, and 1 added to this gives 1·225, the amount of 1*l.* for the time; then $64 \cdot 5 \times 1 \cdot 225 = 79 \cdot 0125$, or 79*l.* 0*s.* 3*d.* the amount.

Case II.

The interest, or the amount, rate, and the time given, to find the principal.

Rule.—Divide the interest by the product of the rate and time, and the quotient will be the principal; or divide the amount by 1 added to the product of the rate and time, and the quotient will be the principal.

EXAMPLES.

What sum of money will gain 14*l.* 10*s.* 3*d.* in $4\frac{1}{2}$ years, at 5*l. per cent, per annum?*

First, $\cdot 05 \times 4 \cdot 5 = \cdot 225$, the product of the rate and time; and $14 \cdot 5126 \div \cdot 225 = 64 \cdot 5$*l.* or 64*l.* 10*s.* the principal required.

What sum will amount to 79*l.* 0*s.* 3*d.* in $4\frac{1}{2}$ years, at 5*l. per cent, per annum?*

First, 1·225 is 1 added to the product of the rate and time; and 79·0125*l.* ÷ 1·225 = 64·5 or 64*l.* 10*s.* is the principal.

Case III.

The principal, rate, and amount, or interest given, to find the time.

Rule.—The difference between the interest and the amount is the interest; and the interest divided by the product of the principal and rate, gives the time.

EXAMPLES.

In what time will 64*l.* 10*s.* amount to 79*l.* 0*s.* 3*d.* at 5*l. per cent, per annum?*

First, 79*l.* 0*s.* 3*d.*—64*l.* 10*s.* = 14*l.* 10*s.* 3*d*, or 14·5125*l.* the interest; and (14·5125 ÷ 64·5) × ·05 = 4·5, or $4\frac{1}{2}$ years, the time.

Case IV.

The principal, time, and amount, or interest given, to find the rate.

Rule.—Divide the interest by the product of the principal and time; the quotient will be the rate.

EXAMPLES.

At what rate per cent, will 64*l.* 10*s.* gain 14*l.* 10*s.* 3*d.* in $4\frac{1}{2}$ years?

First, 64·5 × 4·5 = 290·25*l.* the product of the principal and time; then 14·5125 ÷ 290·25 = ·05, the interest of 1*l.* for 1 year; and 100 × ·05 = 5*l.* the rate.

The last question and most of the foregoing, may be performed by the rule of three; for if 64*l.* 10*s.* gain 14*l.* 10*s.* 3*d.* in $4\frac{1}{2}$ years, what will 1*l.* gain in 1 year?

As 64·5*l.* : 4·5*y.* :: 14·5125*l.* :: 1*y.* : 1*l.*

$$\frac{14\cdot5125l. \times 1 \times 1}{64\cdot5 \times 4\cdot5} = \cdot05 \text{ } \textit{as before.}$$

EXAMPLES.

(1) What will 346*l.* 10*s.* gain in 6 years, at 5*l. per cent, per annum?*

(2) What sum will gain 12*l.* 7*s.* 9*d.* in one year, at 5*l. per cent, per annum?*

(3) What will 77*l.* 10*s.* amount to in $8\frac{3}{4}$ years, at $4\frac{1}{2}$*l. per cent, per annum?*

(4) What sum will amount to 1000*l.* in $7\frac{3}{4}$ years, at 4*l.* 18*s. per cent, per annum?*

(5) In what time will 348*l.* 10*s.* gain 104*l.* 11*s.* interest, at 5*l.* *per cent, per annum?*

(6) In what time will 274*l.* 12*s.* amount to 371*l.* 9*s.* 7*d.*, at 4*l.* 18*s.* *per cent, per annum?*

(7) What will 127*l.* 16*s.* 6*d.* amount to in 5 years and 126 days, at 4*l.* 17*s.* 6*d.* *per cent, per annum?*

(8) What sum of money will gain 50*l.* in 5 years and 50 days, at 4·725*l.* *per cent, per annum?*

(9) At what rate of simple interest will 25*l.* amount to 68*l.* 15*s.* in 50 years?

(10) What will 18*s.* 6*d.* gain in 124 years and 48 days, at 4*l.* 19*s.* *per cent, per annum?*

(11) What will 1*l.* amount to, forborne 36 years, at 5*l.* *per cent, per annum?*

(12) What sum will amount to 3536*l.* 12*s.* $1\frac{1}{4}d.$ in 7 years, at 4·25*l.* *per cent, per annum?*

(13) In what time will 35*l.* amount to 68*l.* 5*s.* at the rate of 4*l.* 15*s.* *per cent, per annum?*

(14) What will 15*s.* amount to in 56 years, at 3*l.* 19*s.* *per cent, per annum?*

(15) At what rate will 549*l.* 4*s.* amount to 742*l.* 19*s.* 1*d.* in 7 years and 73 days?

(16) What sum will gain 296*l.* 1·03′*s.* in 1 year, at 4*l.* 15*s.* *per cent?*

(17) What sum will amount to 2 guineas in 36 years, at 5*l.* *per cent, per annum?*

(18) In what time will 716*l.* 9*s.* 6*d.* amount to 729*l.* 16*s.* 1·08*d.* at 5*l.* *per cent?*

(19) At what rate of simple interest will 17*s.* 6*d.* amount to 1*l.* 14*s.* $1\frac{1}{2}d.$ in 20 years?

(20) What must be paid for the loan of 247*l.* 14*s.* for 17 years 2 months 15 days, at $4\frac{3}{4}$*l.* *per cent?*

(21) At what rate *per cent* will 716*l.* 9*s.* 6*d.* amount to 723*l.* 12*s.* 9·54*d.* in 73 days?

COMPOUND INTEREST.

When interest is continually adding to the principal, and interest is allowed for the same, it is called compound interest.

The rate to be used in the following rules is the interest of one pound.

The principal is the money lent.

The amount is the sum of the principal and interest, wherefore the total interest is the difference between the amount and principal.

The amount of 1*l.* for any number of years not exceeding 10, at 3*l*, $3\frac{1}{2}l$, 4*l*, $4\frac{1}{4}l$, $4\frac{1}{2}l$, $4\frac{3}{4}l$, and 5*l*, *per cent, per annum*, is exhibited in the following

TABLE OF COMPOUND INTEREST.

yrs.	3 *per cent.*	$3\frac{1}{2}$ *per cent.*	4 *per cent.*	$4\frac{1}{4}$ *per cent.*	$4\frac{1}{2}$ *per cent.*	$4\frac{3}{4}$ *per cent.*	5 *per cent.*
$\frac{1}{4}$	1·00741	1·00863	1·00986	1·01046	1·01106	1·01166	1·01227
$\frac{1}{2}$	1·01488	1·01735	1·01980	1·02103	1·02225	1·02247	1·02469
$\frac{3}{4}$	1·02242	1·02914	1·02985	1·03171	1·03356	1·03541	1·03727
1	1·03000	1·03500	1·04000	1·04251	1·04500	1·04750	1·05000
2	1·06090	1·07123	1·08160	1·08680	1·09203	1·09723	1·10250
3	1·09273	1·10872	1·12486	1·13299	1·14117	1·14937	1·15763
4	1·12551	1·14752	1·16986	1·18114	1·19252	1·20397	1·21551
5	1·15927	1·18769	1·21665	1·23134	1·24618	1·26116	1·27628
6	1·19405	1·22926	1·26532	1·28664	1·30226	1·32106	1·34010
7	1·22987	1·27228	1·31593	1·33824	1·36086	1·38382	1·40710
8	1·26677	1·31681	1·36857	1·39511	1·42210	1·44554	1·47746
9	1·30477	1·36290	1·42331	1·45440	1·48610	1·51140	1·55133
10	1·34392	1·41060	1·48024	1·51625	1·55297	1·59052	1·62890

Case I.

The principal, rate, and time given, to find the amount.

Rule.—Add 1 to the rate, involve the sum to the power of the time, *viz.* multiply it by itself for two years, that product by the same for three years, and that product still by the same for four years, &c., the last product will be the amount of 1*l.* in that time, which multiplied by the principal, will give its amount for the same time. (*a*)

By logarithms.—Add 1 to the rate, multiply the logarithm of the sum by the time, to the product add the logarithm of the principal; the product will be the logarithm of the amount. (*b*)

By the table.—Find the amount of 1*l.* for the given time and rate, but if the time exceed the limits of the table, take two or

---

(*a*) What will 46*l.* amount to in 3 years, at 5*l.* *per cent, per annum*, compound interest?

·05*l.* is the interest of 1*l.* for 1 year, and 1·05*l.* the amount ∴ 1·05*l.* × 1·05 = 1·1025 = the amount for 2 years, and 1·05*l.* × 1·05 × 1·05 = 1·157625 = the amount of 1*l.* for 3 years, so that 1·05 × 1·05 × 1·05 × 46 = 53·25075*l.* = 53*l.* 5*s.* $1\frac{3}{4}d.$ ·2 the amount of 46*l.* for 3 years.

(*b*) The logarithm of 1·05*l.* is 0·0211893 which multiplied by 3 gives 0·0635679 to which add the logarithm of 46, which is 1·6627578 gives 1·7263257 the logarithm 53·25075*l.* *as before.*

more such times that their sum will be the given time, then the product of the amounts, corresponding therewith, will be the amount of 1*l.* for the whole time, then the amount of 1*l.* multiplied by the annuity will give the amount required. (*c*)

EXAMPLES.

(1) What will 147*l.* amount to in 7 years, at 5*l. per cent, per annum*, compound interest?

(2) What will 65*l.* gain in $7\frac{1}{2}$ years, at $4\frac{3}{4}$*l. per cent, per annum*, compound interest?

(3) What will 100*l.* amount to in 34 years, at $4\frac{1}{2}$*l. per cent, per annum*, compound interest?

(4) What will 64*l.* 14*s.* 6*d.* amount to in $14\frac{3}{4}$ years, at 4*l.* 10*s. per cent, per annum*, compound interest?

(5) What will 2*l.* 10*s.* amount to in 28 years, at 5*l. per cent, per annum*, compound interest?

Case II.

The interest, or the amount, rate, and time given, to find the principal.

Rule.—Add 1 to the rate, involve the sum to the power of the time; or find the amount of 1*l.* for the given time at the given rate; then divide the given amount by the amount of 1*l.* so found; the quotient will be the required principal. Or, divide the interest by 1 less than the amount of 1*l*, the quotient will be the required principal. (*d*)

The amount of 1*l.* may be found in the table, as in the first case.

Logarithmically.—Add 1 to the rate, multiply the logarithm

(*c*) Or the amount of 1*l.* in 3 years, at 5*l. per cent*, in the table is 1·157625*l.* which multiplied by 46, gives 53·25075*l. as before.*

If the tabular amount for $17\frac{3}{4}$ years was required, the amount for ten years at 5*l. per cent* is 1·62890, for 7 years 1·40710, and for $\frac{3}{4}$ of a year 1·03737, the product whereof, *viz.* 1·62890×1·40710×1·03727 =2·3774489688313 will be the amount of 1*l.* in $17\frac{3}{4}$ years, at 5*l. per cent.*

(*d*) What sum of money will amount to 53*l.* 5·015*s.* in 3 years, at 5*l. per cent, per annum*, compound interest?

This being just the reverse of the former case, it is only reversing the operation, thus 1×1·05 × 1·05×1 05=1·157625*l.* which is also the tabular amount of 1*l.* in 3 years. Now if 1·157625*l.* be the amount of 1, what will 53*l.* 5·015*s.* or 53·25075*l.* be the amount of? Stated *as* 1·157625*l.* : 1 :: 53·25075*l*, which is only dividing 53·25075 by 1·157625 gives 46*l.* the principal required. *Or*, if it was required what sum would gain 7·25075*l*, then 1 subtracted from 1·157625 leaves ·157625 for the gain of 1*l*, and as ·157625 : 1 :: 7·25075 : 46*l.*

Or 53·25075 divided by 1·05 three times will give 46*l.*

of the sum by the time, subtract the product from the logarithm of the amount; the remainder will be the logarithm of the principal. (*e*)

EXAMPLES.

(1) What sum will amount to 206*l.* 16*s.* 10½*d.* in 7 years at 5*l.* *per cent, per annum*, compound interest?

(2) What sum of money will gain 26*l.* 19*s.* 4½*d.* interest in 7½ years, at 4¾*l.* *per cent, per annum*, compound interest?

(3) What sum of money will gain 346*l.* 12*s.* 9¼*d.* in 34 years, at 4½*l.* *per cent, per annum*, compound interest?

Case III.

Principal, rate, and amount given, to find the time.

Rule.—Add 1 to the rate, divide the amount by the principal, and this quotient continually by the former, till the quotient be less than the divisor, the number of these divisions will be the number of years; then divide the last quotient by the same divisor, and you will have the parts of a year. *Or*, divide the amount by the principal, the quotient will be found in the table under the rate against the time. (*f*)

Logarithmically. From the logarithm of the amount subtract the logarithm of the principal; divide the remainder by the logarithm of the rate plus 1, the quotient will be the time. (*g*)

EXAMPLES.

(1) In what time will 147*l.* amount to 206*l.* 16*s.* 10½*d.* at 5*l.* *per cent, per annum*, compound interest?

(2) In what time will 65*l.* gain 26*l.* 19*s.* 4½*d.* at 4¾*l.* *per cent, per annum*, compound interest?

(3) In what time will 100*l.* amount to 446*l.* 12*s.* 9¼*d.* at 4½*l.* *per cent, per annum*, compound interest?

(*e*) Or the logarithm of 1·05 multiplied by 3, and the product subtracted from the logarithm of 53·25075 leaves the logarithm of 46.

(*f*) In what time will 46*l.* amount to 53·25075*l.* at 5*l.* *per cent, per annum*, compound interest?

53·25075÷46=1·157625, the amount of 1*l.* in the same time.

1·157625÷1·05=1·1025, amount of 1*l.* in one year less time.

1·1025÷·05, the amount in two years less time.

1·05÷·05, the amount, 3 years before, which being the principal of 1*l.* the time is three years.—If the last quotient had been something between 1 and 1·05, then that quotient divided by 1·06 would give the parts of a year nearly. *Or*, 1·157625 as above found in the table under 5*l.* *per cent*, stands against 3 years, the time required.

(*g*) Or the logarithm of 46 subtracted from the logarithm of 53·25075, the remainder divided by the logarithm of 1·05 gives 3 years.

(4) In what time will any sum be doubled by remaining at compound interest, at 5*l. per cent, per annum?*

Case IV.

Principal, time, and amount given, to find the rate.

Rule.—Divide the amount by the principal; the root of the power of the time of the quotient, will be the rate plus 1.—*Or*, the quotient found in the table against the time, will stand under the rate. (*h*)

Logarithmically. From the logarithm of the amount subtract the logarithm of the principal, divide the remainder by the time, the quotient will be the logarithm of the rate plus unity.

EXAMPLES.

(1) At what rate of compound interest will 147*l.* amount to 206*l.* 16*s.* 10½*d.* in 7 years?

(2) At what rate of compound interest will 65*l.* gain 26*l.* 14*s.* 4½*d.* in 7½ years?

(3) At what rate of compound interest will 100*l.* amount to 446*l.* 12*s.* 9¼*d.* in 34 years?

ANNUITIES.

An annuity is a yearly payment, as of rent, interest, or pension, &c., the value or amount of which at the end of a given time or its present worth or value at the beginning of the time; by first finding a principal the interest whereof will be the annuity; then the amount of such principal, lessened by the principal, will be the amount of its interest, or the amount of the annuity; then the present worth of such amount is found by the second case in compound interest.

Case I.

The annuity, rate, and time given, to find the amount.

Rule.—As the interest of 1*l.* is to 1*l*, so is the annuity to a

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(*h*) At what rate of compound interest will 46*l.* amount to 53·25075*l.* in 3 years?

Here 53·25075÷46=1·15762, the amount of 1*l.* in 3 years; the cube root of which, or by any method a number found by which dividing 1·15762 three times will leave no remainder.—*Or*, 1·15762 in the table against the time will be found under 5*l. per cent.*

If the time exceed the limits of the table, the square root of the amount of 1*l.* will be its amount for half the time; or the cube root thereof will be its amount for one-third of the time; thus may the time be halved or divided by 3 as oft as you please.

principal, the interest of which will pay the annuity, then the amount of that principal found by the first case in compound interest, and the principal subtracted therefrom, leaves the interest or amount of the annuity. (*a*)

EXAMPLES.

(1) What will an annuity of 20*l. per annum*, amount to in 7 years, at 5*l. per cent per annum*?
(2) What will an annuity of 56*l.* 10*s. per annum*, amount to in 14 years, at 5*l. per cent, per annum*, compound interest?
(3) What will an annuity of 26*l.* 14*s. per year*, amount to, forborne $25\frac{1}{2}$ years, at $4\frac{1}{2}$*l. per cent*, compound interest?

Case II.

Annuity, rate, and time given, to find the present worth.

Rule.—Find the amount by the last case, then the present worth of that amount may be found by the second case in compound interest. (*b*)

EXAMPLES.

(1) What is the present worth of an annuity of 25*l. per annum*, to continue 4 years, when compound interest is allowed at 5*l. per cent, per annum*?
(2) What must be given for an annuity of 36*l.* 15*s.* to continue 14 years, compound interest being at $4\frac{3}{4}$*l. per cent*?
(3) A person would sell an annuity of 75*l. per annum*, to continue 21 years for ready money, allowing compound interest at $4\frac{1}{2}$*l. per cent*, what must he receive?

(*a*) What will 20*l. per annum* amount to in 6 years, at 5*l. per cent, per annum*, compound interest?

As ·05*l.* : 1 :: 20, *viz.* 20÷·05=400*l*, the interest of which is 20*l. per annum*, then by the first case in compound interest, the amount of 400*l.* in 6 years, at 5*l. per cent*, will be found to be 536·04*l*, then 536·04*l.*—400*l.*=136·04*l*, 6 years' interest of 400*l*, or the amount of the 20*l. per year* in 6 years.—The reason is evident, for the interest of 400*l*, at 5*l. per cent*, is 20*l. per year*, wherefore the amount of that interest is the amount of 20*l. per year*.

(*b*) What is the present worth of an annuity of 20*l*, to continue 6 years, at 5*l. per cent, per annum*, compound interest?

The amount by the last case is found to be 136·04*l*, then to find the present worth of 136·04*l.* due in 6 years, by the second case in compound interest, divide 136·04 by the amount of 1*l*, or by 1·05×1·05×1·05×1·05×1·05×1·05, or the tabular amount of 1·3401, the quotient is 101·51*l.* the present worth required.

Case III.

The amount, rate, and time given, to find the annuity.

Rule.—This is the same as having the interest, rate, and time given, to find the principal; therefore find the interest of 1*l.* for the given time, at the given rate; then say as that interest is to 1*l*, so is the given amount to the principal, the yearly interest whereof will be the annuity. (*c*)

Note.—If the present worth be given, find its amount for the given time, then work as before directed with the amount.

EXAMPLES.

(1) What annuity forborne 3 years will amount to 65*l*, at 5*l.* *per cent, per annum,* compound interest?

(2) What annuity forborne 7 years will then amount to 400*l.* compound interest being at 5*l.* *per cent?*

(3) What annuity must be forborne 21 years, at $4\frac{1}{2}l.$ *per cent,* compound interest, to amount to 1000*l*?

(4) What annuity, to continue 6 years at 5*l.* *per cent, per annum,* will 100*l.* ready money purchase?

(5) What annuity, to continue 9 years at $4\frac{1}{2}l.$ *per cent,* will 165*l.* purchase?

(6) What annuity, to continue $14\frac{1}{2}$ years at $4\frac{3}{4}l.$ *per cent,* will 400*l.* purchase?

Case IV.

Annuity, rate, and amount given, to find the time.

Rule.—Divide the annuity by the rate, the quotient will be a principal, the interest whereof will pay the annuity; this principal, added to the amount of the annuity, will make the amount of such principal, with which work for the time as in the third case in compound interest. (*d*)

(*c*) What annuity will amount to 136·04*l.* in 6 years, at 5*l.* *per cent, per annum,* compound interest?

The amount of 1*l.* in 6 years, at 5*l.* *per cent,* either by the table or found by multiplying by 1·05 six times, is 1·340*l*, wherefore the interest is ·340*l*, then *as* ·340*l.* : 1 :: 136·04 : 400*l*, and the yearly interest of 400*l.* at 5*l.* *per cent,* is 20*l.* the annuity.

What annuity, to continue 6 years, at 5*l.* *per cent, per annum,* will 101·51*l.* purchase?

The amount of 1*l.* in 6 years, at 5*l.* *per cent,* is 1·3401 as before, then as 1 : 1·3401 :: 101·51 : 101·51 × 1·3401 ÷ 136·04 = the amount of the annuity, then by the former question 136·06 ÷ ·3401 = 400*l*, the annual interest of which is 20*l*, the annuity required.

(*d*) In what time will 20*l.* *per annum* amount to 136·04*l.* at 5*l.* *per cent, per annum,* compound interest?

EXAMPLES.

(1) In what time will an annuity of 25*l.* *per annum* amount to 78·81*l*, at 5*l.* *per cent*, *per annum*, compound interest?

(2) In what time will 30*l.* *per annum* amount to 244·26*l*, at 5*l.* *per cent*, *per annum*, compound interest?

(3) How long must an annuity of 27*l.* 10*s.* *per annum*, be forborne to amount to 291·025625*l*, at 4*l.* *per cent*, *per annum*, compound interest?

(4) In what time will 34*l.* *per annum*, amount to 1000*l*, at $4\frac{3}{4}$*l.* *per cent*, *per annum*?

QUESTIONS IN ANNUITIES.

(1) WHAT sum of money must be lent that the interest thereof may pay an annuity of 47*l.* 10*s.* at 5*l.* *per cent*, *per annum*?

(2) What will an annuity of 47*l.* 10*s.* *per annum* amount to in 7 years, at 5*l.* *per cent*, *per annum*, compound interest?

(3) What is the present worth of an annuity of 47*l.* 10*s.* *per annum*, to continue 7 years, at 5*l.* *per cent*, *per annum*, compound interest?

(4) What annuity, forborne 7 years, will amount to 386*l.* 14*s* 10·8*d.* at 5*l.* *per cent*, *per annum*, compound interest?

(5) What annuity, to continue 7 years, at 5*l.* *per cent*, *per annum*, will 274*l.* 2*s.* $10\frac{1}{2}$*d*, ready money, purchase?

(6) How long must an annuity of 47*l.* 10*s.* continue, to amount to 386*l.* 14*s.* 11*d.* at 5*l.* *per cent*, *per annum*, compound interest?

(7) A man purchased a life annuity of 47*l.* 10*s.* *per annum*, for 274*l.* 2*s.* $10\frac{3}{4}$*d*; what must be the length of his life, that he may be no loser by the purchase, allowing compound interest at 5*l.* *per cent*, *per annum*?

QUESTIONS IN COMPOUND INTEREST AND ANNUITIES.

(1) WHAT will 27*l.* 15*s.* principal amount to in 15 years at 5*l.* *per cent*, *per annum*, compound interest?

As ·05 : 1 :: 20*l.* : 400*l.* a principal which allows 20*l.* *per annum* interest.

400+136·04=536·04, the amount of 400*l.* in the time required.

400 : 536·04 : 1·3401, the amount of 1*l.* in the same time, which divided by 1·05 till the quotient is unity, the number of divisions will be 6, which shows the time to be 6 years; or 1·3401 in the table under 5*l.* *per cent*, will be found against 6 years.

(2) What will the interest of 55*l.* 10*s.* amount to in 15 years, at 5*l. per cent, per annum*, compound interest?

(3) If an annuity of 25*l.* 10*s. per annum* be forborne $7\frac{3}{4}$ years, what will then be due, reckoning compound interest at 5*l. per cent, per annum?*

(4) How long must an annuity of 38*l.* 5*s.* be forborne to amount to 351*l.* 11*s.*, reckoning compound interest at 5*l. per cent, per annum?*

(5) What sum must be lent at $4\frac{1}{2}$*l. per cent, per annum*, compound interest, to amount to 100*l.* in 6 years?

(6) A man dying left his son 100*l.* to be paid to him with interest, when both together amounted to the sum of 150*l.*, at $4\frac{1}{2}$*l. per cent, per annum*, compound interest, how long after the father's death, must the son receive his legacy?

(7) A person would purchase an annuity of 25*l. per annum*, to continue 6 years, what is its worth, compound interest being allowed at $4\frac{1}{2}$*l. per cent, per annum?*

(8) A person lent 111*l*, and at the end of 15 years, received 230*l.* 15*s.* $2\frac{3}{4}$*d*, what was the rate of compound interest?

(9) Whether will 240*l.* gain more at 5*l. per cent, per annum*, simple interest, or at 4*l. per cent, per annum*, compound interest, in 7 years, and how much?

(10) A person has a perpetual income of 27*l.* 10*s. per annum*, which he would sell for a life annuity, now valuing his life at 14 years, what annuity must he receive, allowing compound interest at 5*l. per cent?*

(11) A person takes a farm for 12 years, on which he expends 260*l.* on improvements, which he finds will pay him 7*l. per cent, per annum;* what is the present worth of his gain or loss?

(12) Whether is more advantageous to give 1200*l.* for an estate, or to take a lease thereof for 21 years, at 42*l. per annum;* when compound interest is $4\frac{1}{2}$*l. per cent, per annum?*

(13) The real value of an estate is 840*l.* which is to be purchased for 95 years, what is its value for that term?

DUODECIMALS.

When unity is divided into 12, and each of these into 12 more, and so on, such parts are called duodecimals.

A foot is divided into 12 inches, each inch into 12 parts, each part into 12 seconds, each second into 12 thirds, &c.

MULTIPLICATION. (*a*)

Feet	multiplied by	Feet	produce	Feet.
Feet		Inches		Inches.
Feet		Parts		Parts.
Inches		Inches		Parts.
Inches		Parts		Seconds.
Parts		Parts		Thirds.

(1) Multiply 27 feet 9 inches by 8 feet 6 inches.
(2) Multiply 27 feet $10\frac{1}{2}$ inches by 14 feet 9 inches.
(3) Multiply 48 feet 7 inches by 8 feet.
(4) Multiply 23 feet 9 inches and 6 parts by 7 feet 8 inches.
(5) Multiply 49 feet 7 inches and 8 parts by 14 feet 8 inches 6 parts.
(6) Multiply 74 feet 6 inches 6 parts by 3 feet 4 inches 2 parts.
(7) Multiply 8 feet 7 inches 5 parts by 7 feet 9 inches 4 parts.
(8) Multiply 17 feet $10\frac{1}{2}$ inches by $3\frac{3}{4}$ inches.
(9) Multiply 67 feet 7 inches by 17 feet $8\frac{1}{2}$ inches.
(10) Divide 235 feet 10 inches 6 parts by 27 feet $10\frac{1}{2}$ inches.
(11) Divide 411 feet 1 inch $10\frac{1}{2}$ parts by 27 feet $10\frac{1}{2}$ inches.

SQUARE ROOT.

To extract the square root of any whole number, or a pure or mixed decimal.

Rule.—First. If there be decimals in the given number, make them to consist of *two*, *four*, or *six*, &c., places, by annexing

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	ft.	*in.*	*p.*
(*a*) Multiply	8	7	4
By	5	9	8
	43	0	8
	6	5	6 . 0
		5	8 . 10 . 8
Feet	49	11	10 . 10 . 8

4 parts by 5 feet is 20 parts or 1 inch and 8 parts, 7 inches by 5 feet is 35 inches, to which add 1 inch, make 36 inches=3 feet; 8 feet by 5 is 40 feet, and 3 feet make 43 feet; 4 parts by 9 inches make 36 seconds=3 parts; 7 inches by 9 inches =63 parts; and 3 parts make 66 parts= 5 inches and 6 parts; 8 feet by 9 inches make 72 inches, and 5 inches added make 77 inches=6 feet 5 inches; 4 parts by 8 parts give 32 thirds=2 seconds and 8 thirds; 7 inches and 8 parts give 56 seconds, to which add 2 seconds, make 58 seconds=4 parts and 8 seconds; 8 feet by 8 parts give 64 parts, to which add 4 parts, make 68 parts=5 inches and 8 parts. The sum of which is the product as in the example.

These questions may also be worked by taking parts as in the rules of practice; multiply by 5 feet as above, 6 inches is $\frac{1}{2}$ a foot, 3 inches is $\frac{1}{2}$ of 6 inches, 6 parts $\frac{1}{6}$ of 3 inches, 2 parts is $\frac{1}{3}$ of 6 parts. The like parts of the multiplicand added to the product of 5 feet will give the product as above.

ciphers to the right hand; then separate the whole into periods of *two* figures each, beginning at the right hand, and the left hand period will consist of *one* or *two* figures, according as the number of figures in the whole number is odd or even. (*a*)

Second. Find a square number equal to, or the next less than, the left hand period, and put the root thereof in the quotient; subtract this square from the left hand period, and to the remainder bring down the next period for a dividend.

Third. Double the quotient for a divisor, then consider what figure must be annexed to the right hand thereof, so that if the result be multiplied by that figure, the product may be equal to, or the nearest less number than, the dividend, and it will be the second figure in the root. Then bring down the next period, double the figures in the quotient for a divisor, and proceed in all respects as above, till you have finished the operation. (*b*)

For the proof. Square the root found, and to that product add the remainder, if any; and that sum will be the same as the number given to be extracted.

Squares,	1	4	9	16	25	36	49	64	81
Roots,	1	2	3	4	5	6	7	8	9

Hence we may observe, that if any number end with 2, 3, 7, or 8, the square root of that number can never be exactly found.

(*a*) If it be the square root, they should be divided into two figures each; if the cube, three figures, &c.

Thus, to separate this number, 21035896·12735;
for the second root it will be, 21|03|58|96·|12|73|50;
but for the third root thus, 21|035|896·|127|350;
and for the fourth thus, 2103|5896·|1273|5000;

The root will contain just as many places of figures as there are periods in the given power; and they will be integers or decimals respectively as the periods are so from which they are found, or to which they correspond; that is, there will be as many integers or decimal figures in the root as there are periods of integers or decimals in the given number.

(*b*) What is the square root of 1296?

```
12|96|(36
 9
 ---
66)396
   396
   ---
```

The given square pointed into periods by the rule, 12 is the first period, in which the greatest root is 3, and the square of 3 is 9, which write under 12, and subtracted therefrom there remains 3, to which annex the next period 96 makes 396 for the dividend, double the root or quotient is 6 for the divisor, wanting the unit's figure, therefore I say how oft 6 in 36, answer 6 times, so I put 6 also in the root and in the unit's place of the divisor, makes 66, which multiplied by 6, makes 396, this written under the dividend and subtracted leaves no remainder, so the work is finished.

$36 \times 36 = 1296$, which proves the work.

Rules for the Square Roots of Vulgar Fractions and Mixed Numbers.

First prepare all vulgar fractions by reducing them to their least terms, both for this and all other roots; then

1. Take the root of the numerator and of the denominator for the respective terms of the root required; and this is the best way if the denominator be a complete power; but if it be not, then

2. Multiply the numerator and denominator together; take the root of the product, this root being made the numerator to the denominator of the given fraction or fractional root required.

$$\text{That is, } \sqrt{\frac{a}{b}} = \frac{\sqrt{a}}{\sqrt{b}} = \frac{a}{\sqrt{ab}} = \frac{\sqrt{ab}}{b} = \frac{1}{b}\sqrt{ab}.$$

And this rule will serve whether the root be finite or infinite.

3. Or reduce the vulgar fraction to a decimal, and extract its root.

4. Mixed numbers may be either reduced to improper fractions, and extracted by the first or second rule, or the vulgar fraction may be reduced to a decimal, then joined to the integer, and the root of the whole extracted.

EXAMPLES.

(1) What is the square root of 144?
(2) What is the square root of 576, of 5184, and of 20736?
(3) Extract the square root of 186614, of 746456.
(4) Of 23858·24, of 2746·5891, of 37·5, and of 794967·253.
(5) Of 38476·3736, of 3·47283, of 7, of 2, of ·734268.
(6) Of ·57283, of ·034762, of ·07235, of ·002374.
(7) Of ·00573, of ·0007, of ·00037, of 2000, and 200.
(8) Of 20, of 2, of ·2, of ·02, of ·002, of ·0002.
(9) Of $\frac{16}{25}$, of $7\frac{1}{9}$, of $\frac{150}{216}$, of $\frac{3}{4}$, of $\frac{7}{8}$, of $\frac{64}{81}$.
(10) Of $\frac{256}{729}$, of $\frac{86}{99}$, and $\frac{237}{999}$.

CUBE ROOT.

A new Method of Extracting the Cube Root of any given Number.

Rule.—First. Divide the given number into periods of three figures each, as in the common method, and find the nearest cube to the first period, subtract it therefrom, and put the root in the quotient; then thrice the square of this root will be the trial divisor for finding the next figure.

Second. Multiply the root figure or figures already found by 3, and prefix the product to the next new root figure (which will

be seen by the trial divisor); then multiply this number by the aforesaid new root figure, and place the product two figures to the right, below the trial divisor, and add it to the trial divisor; this sum will be the true divisor.

Third. Under this divisor write the square of the last root figure, which add to the two sums above, and the result is the next trial divisor; the true divisor is found as before directed. (*a*)

Note.—After the first or second decimal place in the root is found, the square of the root figure used in forming the trial divisor may be omitted, and also those two figures that are placed to the right of the trial divisor, in forming the true divisor, as the value of these figures will be too small for their omission to affect the truth of the result. But if the number of decimals in the root is required to be very great, these omissions

---

(*a*) *Examples.*

Extract the cube root of the number 12326391.

12326391(231=*Ans.*

True divisor 2^3 .....=8

Trial divisor.....$2^2 \times 3$=12 — 4326

63 ×3= 189

True divisor .....=1389 ×3=4167

3^2= 9 — 159391

Trial divisor .....=1587

691 ×1= 691

True divisor .....=159391×1=159391

.....

Here the nearest root of the first period of 12 is 2; hence, by the rule, thrice the square of this root figure, or $2^2 \times 3$=12, the trial divisor. Now, with this divisor, we see that 3 must be the next figure of the root, then 2×3=6, and 3 (the new root figure) with 6 prefixed, is 63; this multiplied by the new root figure 3, gives 189, which being placed two figures to the right of the trial divisor, (as directed in the rule,) and added to it, gives the true divisor, 1389. To form the next trial divisor, add the square of the last root figure 3, to the two sums above it, *viz.* 1389, 189, and we have 9+1389+189= 1587, for the next trial divisor. The next figure in the root is evidently 1; then with this new root figure 1, and with three times the preceding part of the root prefixed, is 691, for 23×3=69, and 1 with 69 prefixed is 691, which being placed two figures to the right of the trial divisor, and added to it, gives 159391 for the true divisor.

must not be made till after the third or fourth decimal in the root is found.

To extract the Cube Root of a Vulgar Fraction.

Rule.—Reduce the fraction to its lowest terms, then extract the cube root of the numerator for a new numerator, and the cube root of the denominator for a new denominator; but if the terms will not extract even, multiply the numerator by the square of the denominator, and the cube root of the product divided by the denominator will give the root required. *Or,* reduce the fraction to a decimal, and then extract the root.

Here, $\sqrt[3]{\frac{a}{b}} = \frac{\sqrt[3]{a}}{\sqrt[3]{b}} = \frac{a}{\sqrt[3]{ab^2}} = \frac{\sqrt[3]{ab^2}}{b} = \frac{1}{b}\sqrt[3]{ab^2}$, as in the square root.

EXAMPLES.

(1) What is the cube of 16?
(2) What is the cube root of 13824?
(3) What is the cube root of 110592, of 884736, of 7077·888?
(4) What is the cube root of 56623·104, of 452984·832, of 3623·878656?
(5) What is the cube root of 1427836729, of 79635·28, of 3264·79246?
(6) What is the cube root of 3000, of 500, of 30, of 3, of ·3, of ·03, of ·003?
(7) What is the cube root of ·0003, of ·00003, of $\frac{27}{64}$, of $\frac{26}{32}$, of $\frac{375}{638}$, of $\frac{7}{8}$, of $\frac{23}{99}$?

SOME USES OF THE SQUARE ROOT.

The areas of similar superficial figures are to one another as the squares of their like dimensions, *viz.* as the square of any dimensions to the area of the figure, so is the square of the like dimension of a similar figure to its area. (*a*)

EXAMPLES.

(1) If the diameter of a circle be 1, its area will be ·7854; now if the diameter of another circle be 11·3, what is its area?
(2) If the circumference of a circle be 1, its area will be ·07958; but if the circumference of a circle be 35·5, what is its area?

(*a*) If the diameter of a circle be 4, its area will be 12·6, what is the area of a circle when its diameter is 6?

As 4 × 4 : 12·6 :: 6 × 6 : 28·35, the area.

(3) If the side of a regular hexagon be 2, its area will be 10·3923; but if the side of another regular hexagon be 7·7, what is its area?

(4) If the diameter of a circle be 1, and its area be ·7854, what is the diameter of a circle when its area is 401·16?

The square of the side is the area of a square, and therefore the square root of the area is the side of the square. (*b*)

(5) If the side of a square be 14, what is its area?

(6) If the area of a square be 1152, what is the length of each side?

(7) If the area of a circle be 1296, what must be the side of a square to contain the same measure?

The square root of the number of men to be formed into a square, is the number in rank and file, *viz.* the number in length and breadth.

(8) A square body of men consists of 1764, required the number in each side.

In any right angle triangle, the square of the hypothenuse is equal to the sum of the squares of the base and perpendicular, *viz.* of the two sides containing the right angle; therefore the square root of the sum of the squares of the base and perpendicular, is the length of the hypothenuse, and the square root of the difference of the squares of the hypothenuse, and a side is the length of the third side. (*c*)

(9) If the base of a rectangle triangle be 19, and the perpendicular 9, what is the length of the hypothenuse?

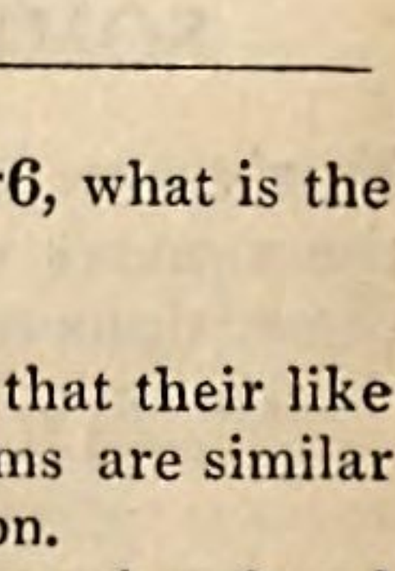
(*b*) If the diameter of a circle be 4, and its area 12·6, what is the diameter of a circle when its area is 28·35?

As 12·6 : 4 × 4 :: 28·35 : 36 and $\sqrt{36}=6$.

Similar figures are such as are both of one shape, so that their like dimensions are proportional; so rectangled parallelograms are similar when their lengths and breadths are in the same proportion.

If the length of one be 6 and breadth 4, the length of another 9 and breadth 6, then as 6 : 4 :: 9 : 6; wherefore they are similar.

(*c*) A B is the perpendicular, B C the base, and A C the hypothenuse of the right angle triangle A B C; then $AB^2 + BC^2 = AC^2$; $\therefore$ $AC^2 - AB^2 = BC^2$; and $AC^2 - BC^2 = AB^2$; which may thus be proved:



(10) If the hypothenuse of a rectangle triangle be 25, and the base 20, what is the length of the perpendicular?

(11) If the hypothenuse of a right angle triangle be 25, and the perpendicular 15, what is the length of the base?

(12) If the base of a right angle triangle be 27 feet, and the perpendicular $18\frac{1}{2}$ feet, what is the length of the hypothenuse?

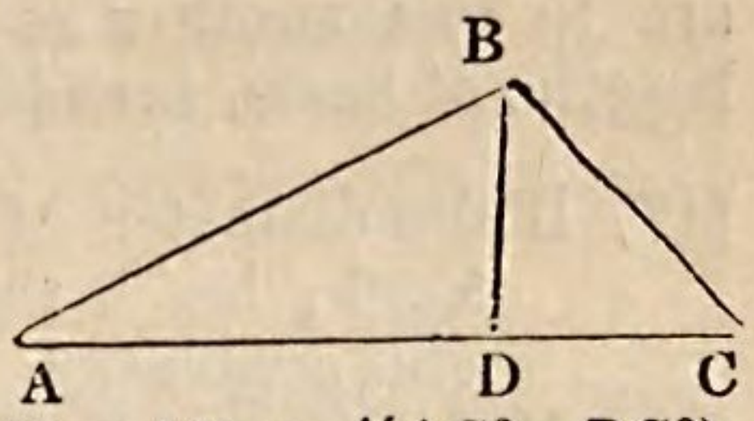
The velocities or swiftness of heavy bodies in falling freely, are as the times and the lengths of their falls are directly as the squares of the times. (*d*)

(13) If a heavy body fall 16 feet 1 inch in one second of time, how far would it fall in $7\frac{1}{2}$ seconds?

(14) In what time will a heavy body fall from the top of a tower which is 32 yards high, to the ground, supposing it to fall 16 feet the first second?

The lengths of pendulums are to one another as the squares of their numbers of vibrations made in the same time inversely. (*e*)

Draw BD perpendicular to AC, then ABD CBD and ABC are similar triangles, and AC : AB :: AB : AD, $\therefore AB^2 = AC \times AD$, and AC : CB :: CB : CD, $\therefore CB^2 = AC \times CD$; $\therefore AB^2 + BC^2 = (AC \times AD) + (AC \times CD) = AC \times AC$, $\therefore AB^2 + BC^2 = AC^2$, $\therefore \sqrt{(AB^2 + BC^2)} = AC$. Also $AB^2 = AC^2 - BC^2$, $\therefore AB = \sqrt{(AC^2 - BC^2)}$, and $BC^2 = AC^2 - AB^2$, $\therefore BC = \sqrt{(AC^2 - AB^2)}$.



Or the square root of the difference of the squares of the base and hypothenuse is the length of the perpendicular; or the square root of the difference of the squares of the hypothenuse and perpendicular is the length of the base, and the square root of the sum of the squares of the base and perpendicular is the length of the hypothenuse.

(*d*) Whatever speed a heavy body acquires by falling at the end of one second it will acquire twice as much at the end of two seconds, three times as much at the end of three seconds, and so on.—Therefore as the square of any given time, to the length it falls through in that time, so is the square of any other given time to the length it would fall through in that time, and *vice versa*.

(*e*) A pendulum 39·2 inches will make 60 swings in a minute; how many swings will a pendulum 64 inches long make in the same time?

39·2 : 60 × 60 :: 64 inversely, $\sqrt{\frac{(39{\cdot}2 \times 60 \times 60)}{64}} = \sqrt{\frac{141120}{64}} = \sqrt{2205} = 21\sqrt{5} = 46{\cdot}957428$ swings. And if it was required what length it must be, to make 46·9 swings, then as 60 × 60 : 39·2 :: 46·9 × 46·9 inversely, *viz.* $\frac{60 \times 60 \times 39{\cdot}2}{46{\cdot}9 \times 46{\cdot}9} = \frac{141120}{2199{\cdot}61} = 64$ inches *nearly*.

(15) A pendulum 39·2 inches long will make 60 vibrations or swings in a minute; what must be the length of a pendulum to make 80 vibrations in a minute?

(16) If a pendulum 39·2 inches long make 60 vibrations in a minute; how many vibrations will a pendulum 48 inches long make in a minute?

USE OF THE CUBE ROOT.

THE capacities of similar solids are to one another as the cubes of the like dimensions.—So the contents of globes are to one another as the cubes of their diameters, or as the cubes of their circumferences; so are the hemispheres, or any like portions of globes. Also cones whose base diameters are to one another in the same proportion as their heights. So are the contents of any of the five regular bodies or any like solids, the dimensions of which are proportional to one another.

The quantities of powder or ball sufficient to discharge different guns are to one another as the cubes of their diameters.

The burdens of ships, which are built in the same proportion, are to one another as the cubes of their like dimensions, as lengths of keels, breadths, &c. (*f*)

(17) If the diameter of a globe be 1, its solid contents will be ·5236; but if the diameter of a globe be 7·5, what is its solid contents?

(18) If the diameter of a globe be 1, its solid contents will be ·5236; if the contents of a globe be 1728, what is its diameter?

(19) If a $\frac{1}{4}$*lb.* of gunpowder be sufficient to charge a gun of $1\frac{1}{4}$ inch bore, how much will be sufficient to charge another gun of $2\frac{3}{4}$ inches bore?

(20) If a ship of 240 tons burden be 32 feet long at the keel, what length of keel must a ship of 480 tons burden have?

(*f*) The capacities or contents of all solid bodies are limited and ascertained by three dimensions; as length, breadth, and thickness: and if three numbers be proportional to three others, the product of one or three will bear such proportion to the cube of one of them, as the product of the other to the cube of one of them, standing in the same order or proportion; so 2, 4, and 6, are in the same ratio with 3, 6, and 9.

For 2 : 4 :: 3 : 6; 2 : 6 :: 3 : 9, and 4 : 6 :: 6 : 9; 2×4×6 : 2×2×2 :: 3×6×9 : 3×3×3; or 2×4×6 : 4×4×4 :: 3×6×9 : 6×6×6; also 2 × 4 × 6 : 6×6×6 :: 3×6×9 : 9×9×9; which might be better illustrated by the assistance of algebra.

(21) If a ship of 240 tons burden be 28 feet long at the keel, what burden will a ship of 42 feet of keel carry?

QUESTIONS IN THE USES OF THE SQUARE AND CUBE ROOTS.

(1) If a square contain 1296 square feet, what is the length of each side?

(2) If 7744 men be formed into a square, how many must be on each side?

(3) If each side of a square be 14 feet, how many square feet are in that square?

(4) If the base of a rectangled triangle be 28, and the perpendicular 21, what is the length of the hypothenuse?

(5) If the area of a circle be 426, what is the side of a square containing the same measure?

(6) If a cannon ball of 3 inches diameter weigh $3\frac{1}{2}lb$, what is the weight of another ball of the same metal when its diameter is $5\frac{1}{2}$ inches?

(7) If the area of a circle be 233·7055875, required the diameter and circumference.

(8) If the hypothenuse of a rectangled triangle be 34, and the perpendicular 18, what is the length of the base?

(9) If a ladder 32 feet long will just reach the top of a wall when standing at 12 feet distance from the foot thereof, what is the height of the wall?

(10) If a pendulum 39·2 inches long, will make 60 swings in a minute, how many swings will another pendulum make in a minute, the length of which is 52 inches?

(11) How far will a heavy body fall in $3\frac{1}{2}$ seconds, supposing it to fall 16 feet 1 inch the first second?

(12) If a tower be 48 yards high, what time will a stone be in falling from the top to the bottom, allowing it to fall 16 feet the first second?

(13) Two men bought a grinding stone, 42 inches in diameter, which cost 14*s*., of which the first paid 8*s*. and the other 6*s*., and they agree that the first shall have the use of it till his share be worn down; what must be the diameter when the latter receives it?

(14) If a ladder 16 feet long just reach the top of a wall when standing upright against it, how far will it be short of reaching the top when its foot is 9 feet distant from the wall?

(15) If the diameter of a bushel measure be 18·5 inches, and its depth 8 inches, what must be the diameter of a two bushel measure, when the depth is the same as the former, and when the diameter and depth are in the same proportion with those of the former?

ARITHMETICAL PROGRESSION.

When a rank or series of numbers have one common difference, by which they increase or decrease, they are said to be in arithmetical progression, or ratio.

Thus 2, 4, 6, 8, 10, &c., are terms in arithmetical progression, having 2 for their common difference; as also are 10, 8, 6, 4, 2, which decrease by their common difference 2.

The first and last terms of the progression are called the *extremes*.

The common difference is called the *ratio*.

The middle term is called the *mean*.

If four numbers be in arithmetical progression, the sum of the two extremes will be equal to the sum of the two means. If 2, 5, 8, and 11, be in arithmetical progression, then $2+11=5+8$.

If three numbers be in arithmetical progression, the sum of the two extremes will be the double of the mean. If 3, 6, 9, be in arithmetical progression, then $3+9=12=6\times 2$.

Therefore the mean term is equal to half the sum of the extremes, or to half the sum of any two terms equally distant from the mean, when the number of terms is odd. If 2, 4, 6, 8, 10, 12, 14, be numbers in arithmetical progression, then $(2+14)\div 2=8$, and $(4+12)\div 2=8$.

If the number of terms be even, then the sum of the two extremes is equal to the sum of any two terms equally distant from them.

If 3, 6, 9, 12, 15, 18, be in arithmetical progression, then $3+18=6+15=9+12$.

The sum of any number of the odd terms, as 1, 3, 5, 7, &c., will be a square number; thus $1+3=4$; $1+3+5=9$.

1. *To find the sum of any increasing arithmetical progression or series.*

Rule.—Subtract unity, or 1 from the number of terms, multiply this by the common difference; to this product add twice the first term, and multiply this sum by half the number of terms.

2. *Given the least term, the greatest term, and the number of terms, of an arithmetical progression, to find the sum of all the terms.*

Rule.—Multiply the sum of the least and greatest terms by half the number of terms, and the product will be the sum of all the terms.

3. *To find the common difference, when the least and greatest terms, and the number of terms are given.*

Rule.—Find the difference between the greatest and least

terms; divide this difference by the number of terms diminished by unity, and the quotient will be the common difference.

4. *To find the number of terms when the least and greatest terms and the common difference are given.*

Rule.—Divide the difference between the greatest and least terms by their common difference; to the quotient add 1; the sum will be the number of terms.

5. *Given the greatest term, the number of terms, and the common difference, to find the least term.*

Rule.—Subtract unity from the number of terms, multiply this by the common difference, and subtract the product from the greatest term; the remainder will be the least term.

6. *If the sum of the terms, the common difference, and the number of terms be given, to find the least term.*

Rule.—Subtract unity from the number of terms, multiply this by half the common difference, and subtract this product from the quotient of the sum of the terms divided by the number of terms; the result will be the least term.

7. *The greatest term of an arithmetical progression may be found when the number of terms, the common difference, and the least term, are given.*

Rule.—Subtract unity from the number of terms, multiply this by the common difference, to the product add the least term, and the sum will be the greatest term.

EXAMPLES.

(1) What will be the sum of 14 terms of the series 1, 3, 5, &c.?
(2) Find the sum of 25 terms of the series 2, 5, 8, 11, &c.
(3) Find the sum of 32 terms of the series 1, $1\frac{1}{2}$, 2, $2\frac{1}{2}$, &c.
(4) Find the sum of 150 terms of the series of $\frac{1}{3}$, $\frac{2}{3}$, 1, $\frac{4}{3}$, $\frac{5}{3}$, 2, &c.
(5) The least term of an arithmetical series is 2, the greatest is 26, and the number of terms is 13; what is the sum of all the terms?
(6) The least term of an arithmetical series is 1, the number of terms 32, and the greatest is 63; what is the sum of all the terms?
(7) The last term of an arithmetical series is 92, the first term is 5, and the number of terms 30; what is the common difference?
(8) The greatest term of an arithmetical series is 30, the number of terms is 10, and the first term 3; what is the common difference?

(9) What is the number of terms of an arithmetical series when the least term is 7, the common difference 2, and the greatest term 47?

(10) The greatest term of an arithmetical series is 84, the common difference is 4, and the number of terms is 21; required the other term.

(11) The common difference of an arithmetical series is 1, the number of terms 43, and the greatest term is 46; what is the least term?

(12) The sum of an arithmetical series is 950, the common difference 3, and the number of terms 25; what is the least term?

(13) The number of terms of an arithmetical progression is 19, the common difference is 3, and the least term is 2; what is the greatest term?

(14) The common difference of an arithmetical progression is $\frac{1}{8}$, the number of terms 41, and the least term 4; what is the greatest term?

(15) The greatest term of an arithmetical series is 398, the least 3, and the common difference 5; what is the number of terms?

(16) A man made 6 payments, the first 3*l*, the last 23*l*, the differences between each two were equal; what was the common difference and the sum of the payments?

(17) A man had 6 sons, whose ages were in arithmetical progression, the oldest was 23 years old, and the youngest 8; what was their common difference?

(18) A man is to make 8 payments, the first 4*l*, and each payment is to exceed the former by 2*l*; what is the last payment and the sum of all?

(19) If 100 eggs be placed in a right line, at the distance of one yard from each other, and the first one yard from a basket; how far must a man travel to fetch them one by one into the basket?

(20) A man has a debt to discharge in one year by weekly payments in arithmetical progression, the first payment is to be 1*s*. the last 7*l*. 14*s*; what is the common difference and the sum of all the payments?

(21) It is found that a heavy body near the earth's surface descends by its own weight (from rest) the space of $16\frac{1}{12}$ *feet* in the first second of time, $48\frac{3}{12}$ *feet* in the next second, $80\frac{5}{12}$ *feet* in the third second, and so on, constituting a series in arithmetical progression, whose first term is $16\frac{1}{12}$ *feet*, and common difference $32\frac{2}{12}$ *feet*; now according to this *law*, how far would a heavy body descend in 10 seconds? (*See Note* 4, *page* 34.)

Ans. $1608\frac{1}{3}$ *feet.*

GEOMETRICAL PROGRESSION.

When a series or rank of numbers increases or decreases by the continual multiplication or division of the same quantity, those numbers are said to be in geometrical progression.

Thus, the numbers 1, 2, 4, 8, 16, 32, &c. are in geometrical progression, and the number by which each preceding term is multiplied, is called the common ratio.

Also 1, $\frac{1}{3}$, $\frac{1}{9}$, $\frac{1}{27}$, &c. are in geometrical progression, the common ratio of which is $\frac{1}{3}$.

The greatest and least terms are called the extremes.

If a series or geometrical progression be supposed to be continued without end, or "in infinitum," it is called an infinite series.

In any geometrical series, the product of the two extremes is equal to the product of any two means that are equally distant from them; or to the square of the mean, when the number of terms is odd.

If the series be 1, 2, 4, 8, 16, 32, 64, &c.

Then $1 \times 64 = 2 \times 32 = 4 \times 16$.

Also $1 \times 64 = 8 \times 8$.

Therefore the square of any term of a geometrical progression is equal to the product of any two terms equally distant from it.

Thus, in the series 1, 2, 4, 8, 16, 32, &c.

$2 \times 2 = 1 \times 4$; $4 \times 4 = 2 \times 8$; $8 \times 8 = 4 \times 16$; &c.

If three terms be in geometrical ratio, the first is to the second as the second is to the third.

A geometrical mean proportion may, therefore, be found between any two given terms, by taking the square root of the product of the two given terms.

If four terms be in geometrical ratio, the first is to the second as the third is to the fourth.

1. *To find the last term of a geometrical series.*

Rule.—To the product arising from multiplying the first term by the number of times the ratio is to be multiplied by itself, which is denoted by the number of terms required, diminished by unity.

Let the first term be 2, the ratio 3, and the number of terms 5, what is the last term?

The number of terms being 5, subtract unity from it, then multiply the ratio, which is 3, four times by itself.

$3 \times 3 \times 3 \times 3 = 81$, this being multiplied by 2, the first term will give 162, the last term.

Or, 2, 6, 18, 54, 162, the last term as before.

2. *To find the sum of a series of numbers in geometrical progression.*

Rule.—Subtract the first term from the product of the last

term and common ratio, and divide the remainder by the common ratio diminished by unity.

3. *To find the first term of a geometrical progression.*

Rule.—Multiply the difference between the common ratio and unity by the sum of the series, subtract this product from the product of the ratio and last term; the remainder will be the first term.

4. *To find the common ratio of a geometrical progression.*

Rule.—Divide the difference between the sum of the series, and the first term by the difference between the sum of the series and the last term.

5. *To find a descending geometrical series, when the ratio is* 2.

Rule.—Double the first or greatest term is equal to the sum of all the terms ad infinitum.

6. *To find any descending geometrical series.*

Rule.—The last term subtracted from twice the greatest, will leave the sum of all the terms.

7. *To find any geometrical series.*

Rule.—If the greatest term be multiplied by the ratio, the least term subtracted from the product, the remainder divided by one less than the ratio, will give the sum of all the terms in that series.

8. *To find any infinite descending geometrical series.*

Rule.—The first or greatest term multiplied by the ratio, and the product divided by one less than the ratio, will give the sum of all the terms in infinitum.

9. *To find the sum of a geometrical series, ad infinitum, when the ratio is a proper fraction.*

Rule.—Divide the first term by the common ratio subtracted from unity and the quotient will be the sum required.

10. *To insert any number of geometrical means between the first and last term of a geometrical progression.*

Rule.—Divide one quantity by the other, and take the root of this quotient, which is denoted by adding unity or 1 to the number of means required; the result will be the common ratio. Multiplied by this ratio continually, and the means may be found.

EXAMPLES.

(1) There are three terms in geometrical progression, the extremes are 16 and 64; which is the mean?

(2) Required a geometrical mean proportion between 9 and 49; also between 25 and 81.
(3) There are three terms in geometrical proportion, the first is 9, the second 12; what is the third?
(4) The first term of a geometrical series is 1, the ratio 4, and the number of terms 6; what is the last term?
(5) Required the sum of the series 1, 3, 9, 27, &c. to 12 terms.
(6) Required the sum of the series 1, $\frac{1}{3}$, $\frac{1}{9}$, $\frac{1}{27}$, &c. to 8 terms.
(7) The first term of a geometrical series is 6, the ratio is 4, and the number of terms 5; what will be the sum of the 5 terms, and what will be the last term?
(8) Sum the series 64, 16, 4, &c. to infinitum.
(9) What is the sum of the series 2187, 729, 243, &c. continued to 1 and to infinitum?
(10) Sum the series 1, 2, 4, 8, 16, &c. to 10 terms.
(11) What is the sum of 12 terms of the series 7, 21, 63, &c.?
(12) What is the sum of the series 64, 32, 16, &c., continued to infinitum?
(13) Find the sum of the series 1, $\frac{1}{2}$, $\frac{1}{4}$, &c., to infinitum.
(14) Find the sum of the series $\frac{1}{5}$, $\frac{1}{25}$, $\frac{1}{125}$, &c., to infinitum.
(15) Find the sum of the series 1, $\frac{3}{4}$, $\frac{9}{16}$, $\frac{27}{64}$, &c., to infinitum.
(16) The last term of a series is 512, the ratio 2, and the sum of the terms 1023; what is the first term?
(17) The sum of a series is 6560, the first term is 2, and the last term 4374; what is the common ratio?
(18) Required the sum in infinitum of the series 48, 24, 12, 6, &c.
(19) In the series 96, 48, &c. the last term is 3, the greatest 96; what is the sum of the terms?
(20) The greatest term in a descending geometrical series is 972, the ratio is 3, what will be the sum of all the terms?
(21) What will a horse cost by doubling the 32 nails in his shoes with a farthing; *viz.* by giving 1 farthing for the first nail, 2 for the second, 4 for the third, 8 for the fourth, and so on, doubling through all the 32 nails?
(22) If 1*l.* amount to 1·05*l.* in one year, to what will it amount in 16 years?
(23) If 1*l.* amount to 1·04*l.* in one year, to what will it amount in 21 years?
(24) Insert two geometrical means between 4 and 256.
(25) Find three geometrical means between 2 and 32.
(26) Find three geometrical means between $\frac{1}{9}$ and 9.

ALLIGATION.

Alligation teaches to mix simples so as to ascertain the price of the mixture.—The proportional quantities of simples to be

mixed to bear a given price.—The quantities of simples to be mixed with a given quantity of one of them, to bear a given price.—Also to make a mixture of a given quantity and price.

Case I.

The price and quantity of each simple given, to find the price of the mixture.

Rule.—Multiply each price by the quantity, divide the sum of the products by the sum of the quantities; the quotient will be the price of the mixtures. (*a*)

EXAMPLES.

(1) A vintner has 8 gallons of wine at 5*s.* 6*d.* *per gallon*, 6 gallons at 5*s.* *per gallon*, 12 gallons at 4*s.* 6*d.* *per gallon*, and 5 gallons at 4*s.* *per gallon*, which he would mix all together, and desires to know the price of a gallon of the mixture.

(2) A tobacconist mixed 4*lb.* of tobacco at 18*d.* *per pound*, with 9*lb.* at 12*d.* *per pound*; $7\frac{1}{2}$*lb.* at 10*d.* *per pound*; 26*lb.* at $9\frac{1}{2}$*d.* *per pound*; and $12\frac{1}{2}$*lb.* at 8*d.* *per pound*; what is the price of a pound of the mixture?

(3) Having mixed 24 gallons of ale at 10*d.* *per gallon*, 16 gallons at 9*d*, 12 gallons at $8\frac{1}{2}$*d*, and 10 gallons at 8*d.* *per gallon*; what is the value of a gallon of the mixture?

Case II.

The price of each simple and that of the mixture given, to find each quantity.

Rule.—Write the prices which are below the given mean in one column, and the prices which exceed the given mean in another column, over against the former; then take the difference between the price of the mean and that of each simple, and write it against the price which stands opposite to that you have subtracted; and if there be more terms in one column than the other, you may write two terms opposite to one, or one term twice over, then the sum of the two differences will be the

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(*a*) If 16*lb.* of sugar at 4*d*, 12*lb.* at 5*d*, and 28*lb.* at 7*d.* *per pound*, be mixed together, what is the value of a pound of the mixture?

The value of 16*lb.* at 4*d.* is $16 \times 4 = 64d$, of 12*lb.* at 5*d.* is $12 \times 5 = 60d$, and of 28*lb.* at 7*d.* is $28 \times 7 = 196d$, then $64 + 60 + 196 + = 320d$. the value of the whole mixture, and $16lb. + 12 + 28 = 56lb.$ the whole quantity; and if 56*lb.* be worth 320*d.* what is 1*lb.* worth?

As 56*lb.* : 320*d.* :: 1*lb*, which is but dividing 320*d.* by 56, gives $5\frac{3}{4}d.$ very near the value of 1*lb.* required, which is so evident as to need no further explanation.

quantity; thus the differences will be the quantities to each price they are wrote against. (*b*)

EXAMPLES.

(1) A grocer has spices at 9*d*, at 24*d*, at 30*d*, *per pound*; how much of each sort must he take to make a mixture worth 20*d*. *per pound*?

(2) A vintner has Canary at 26*d*. *per quart*, sherry at 20*d*, and Malaga at 15*d*. *per quart*; how much of each must he take to make a mixture worth 19*d*. *per quart*?

(3) How much wine at 10*s*. and 7*s*. *per gallon*, must be mixed together to sell it at 8*s*. *per gallon*?

(4) How much corn at 3*s*, at 4*s*. 6*d*, at 5*s*, at 6*s*. 6*d*, and at 7*s*. *per bushel*, must be mixed together to sell at 6*s*. *per bushel*?

Case III.

The price of each simple, the quantity of them, and the price of the mixture given, to find the other quantities.

Rule.—Find the quantities by the second case; then as the quantity so found, of which the quantity is given, to the said given quantity, so is each of the other quantities so found to each of the quantities required. (*c*)

EXAMPLES.

(1) A farmer would mix barley at 3*s*. *per bushel*, peas at 4*s*. 6*d*. *per bushel*, oats at 5*s*. *per bushel*, and rye at 6*s*. 6*d*. *per bushel*, with 12 bushels of wheat, at 7*s*. *per bushel*; how much of each sort must he take to sell a bushel of the mixture for 6*s*.?

(*b*) How much sugar at 4*d*, 6*d*, 10*d*, 12*d*, and 14*d*, *per pound*, must be mixed together to be worth 8*d*. *per pound*?

$$8d.\begin{cases} 4d.—2lb. \\ 6\ —4 \\ 6\ —6 \end{cases}\Bigg|\begin{array}{l} 10d.—4lb. \\ 12\ —2 \\ 14\ —2 \end{array}$$

4*d*, and 6*d*, the prices below 8*d*, I write in one column; 10*d*, 12*d*, and 14*d*, the prices above 8*d*, I write in the other; and because there is one term more in the latter column than the first, I write one of the first twice, then the difference between 4*d*. and 8*d*. I write against 10*d*, between 6*d*. and 8*d*. against 12*d*, between 6*d*. and 8*d*. against 14*d*, between 10*d*. and 8*d*. against 4*d*, between 12*d*. and 8*d*. against 6*d*, between 14*d*. and 8*d*. against 6*d*; so that there must be 2*lb*. at 4*d*, 4*lb*. at 6*d*, and 6*lb*. at 6*d*, (or 4+6=10*lb*. at 6*d*.) 4*lb*. at 10*d*, 2*lb*. at 12*d*, and 2*lb*. at 14*d*. *per pound*, to make a mixture worth 8*d*. *per pound*, as may be proved by the first case. Questions in this case admit of as many answers as one of the columns can be written in different orders.

(*c*) The reason of the foregoing method may be seen by considering, that if two quantities be proportional to one another, as the differences between their prices and a mean price, the differences between their values and the mean, and the mean value, will be equal to one another;

(2) A grocer has 46*lb*. of sugar at 14*d*. *per lb*. which he would mix with some at 12*d*, some at 9*d*, some at 7*d*, and some at $6\frac{1}{2}d$. *per pound*, so as to sell the mixture at 10*d*. *per pound;* how much of each sort must he take?

(3) A vintner has 13 gallons of wine at 9*s*. *per gallon*, and desires to know how much at 7*s*, at 5*s*, and 3*s*. 6*d*. *per gallon*, he must take to mix therewith, and sell the mixture at 7*s*. 6*d*. *per gallon?*

Case IV.

The price of each simple, the price of the mixture, and the total quantity given, to find each quantity.

Rule.—Find the quantities by the second case; add them together, then say as the sum to the total quantity given, so is each particular quantity found to the particular quantity required. (*d*)

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for at 7*d*. and at 12*d*. *per pound*, if the mean be 9*d*. *per pound*, their differences are 3 and 2, wherefore 3*lb*. at 2*d*. is equal to 2*lb*. at 3*d*.

How much sugar at 10*d*, 7*d*, 6*d*, and at 5*d*. *per pound*, must be mixed with 36*lb*. at 12*d*. *per pound*, to sell the mixtures at 9*d*. *per pound?*

	d.	*lb*.	*d*.	*lb*.
d	12	2	7	3
	10	3	6	1
	10	4	5	1

By the foregoing rule the quantities may be found to be 2*lb*. at 12*d*, 7*lb*. at 10*d*, 3*lb*. at 7*d*, 1*lb*. at 6*d*, and 1*lb*. at 5*d*; but the quantity at 12*d*. should be 36*lb*, wherefore if 2*lb*. be made 36*lb*, what will 7*lb*, 3*lb*, and 1*lb*, be made? The answer is 36*lb*. at 12*d*, 196*lb*. at 10*d*, 54*lb*. at 7*d*, 18*lb*. at 6*d*, and 18*lb*. at 5*d*.

The proportion may be varied by changing the order of the columns.

As 2 : 36 :: 7 : 196
2 : 36 :: 3 : 54
2 : 36 :: 1 : 18

(*d*) How much sugar at 4*d*, 6*d*, 10*d*, 12*d*, and 14*d*, *per pound*, must be taken to make a mixture of 120*lb*. at 8*d*. *per pound?*

	d.	*lb*.	*d*.	*lb*.
8*d*.	4	2	10	4
	6	4	12	2
	6	6	14	2
	—		—	
	12		8	
	8		—	
	—			
	20*lb*.			
	—			

Find the quantities as before, their sum is 20*lb*, which should be 120*lb*, therefore as 20*lb*. is to 120*lb*, so is each quantity so found to the respective quantities required, which gives 12*lb*. at 4*d*, 60*lb*. at 6*d*, 24*lb*. at 10*d*, 12*lb*. at 12*d*, and 12*lb*. at 14*d*. *per pound*.

This also admits of as many answers as one column admits of different orders.

As 20 : 120 :: 2 : 12
20 : 120 :: 10 : 60
20 : 120 :: 4 : 24
20 : 120 :: 2 : 12
20 : 120 :: 2 : 12

120

EXAMPLES.

(1) A tobacconist has tobacco at 2*s.* 4*d.* *per pound*, at 2*s.* 2*d.* at 2*s*, at 20*d*, and 18*d.* *per pound*, how much of each sort must he take to make a mixture of 112*lb*, worth 22*d.* *per lb?*

(2) A vintner has wine at 8*s.* *per gal*, which he would mix with cider at 1*s.* 2*d.* *per gallon*, how much of each must he take to fill a pipe of 126 gallons, and to sell it at 6*s.* *per gallon?*

(3) A grocer has spices at 20*d*, at 16*d*, at 14*d*, and at 12*d.* *per pound*, how much of each sort must he take to make a mixture of 56*lb.* worth 15*d.* *per pound?*

(4) A tea-dealer has an order for 120*lb.* of tea, at 6*s.* 6*d.* *per pound*, but having none at that price, would mix some at 10*s*, some at 8*s*, some at 6*s*, some at 5*s*, and some at 4*s.* 6*d.* *per pound*, how much of each sort must he take?

PRACTICAL QUESTIONS UPON THE COMMON RULES.

(1) If 100*l.* gain 4*l.* 10*s.* interest in 12 months, in what time will it gain 10*l.* 2*s.* 6*d?*

(2) If the carriage of 42*cwt.* for 184 miles cost 16*l.* 16*s*, what must be paid for the carriage of 105*cwt.* the same distance?

(3) Required the value of 5 casks of Irish butter, each 2*cwt.* 1*qr.* 19*lb.* when $2\frac{1}{2}$*cwt.* cost 6*l.* 10*s.* $7\frac{1}{2}$*d.*

(4) What quantity of treacle, at 45*s.* 5*d.* *per cwt*, can I have for 219*l.* 19*s.* $7\frac{1}{2}$*d?*

(5) At $3\frac{1}{2}$ guineas *per acre*, what will be the rent of 337*a.* 2*r.* 14*p?*

(6) If 6 men mow 33 acres of grass in 6 days, how many acres will 10 men mow in the same time?

(7) Required the value of 15 Spanish hides, each $25\frac{3}{4}$*lb.* at $11\frac{3}{4}$*d.* *per pound.*

(8) Required the value of 15 pieces of cloth, each 42 yards, when $17\frac{1}{4}$ yards cost 7 guineas.

(9) When $9\frac{1}{4}$ gallons of brandy cost $10\frac{1}{2}$ guineas, how much will 9 casks cost, each 32*gal.* 3*qts.* 1*pt?*

(10) The sixpenny loaf weighs 3*lb.* 4*oz.* when wheat is 40*s.* a load, what ought it to weigh when wheat is 32*s.* a load?

(11) What quantity of madder, at 95*s.* 6*d.* *per cwt*, can I have for 309*l.* 18*s.* 9*d?*

(12) If a load of potatoes, weighing 12 *score* 12*lb*, cost 7*s.* 6*d*, what will be the price of a measure weighing 90*lb?*

(13) If, when wheat is 37*s.* 6*d.* a load, the shilling loaf weighs

6*lb.* 2*oz.*, what ought it to weigh, when wheat sells at 48*s.* 4*d?*

(14) If a servant's wages be 12½ guineas a year, what is that *per month*, *per week*, and *per day?*

(15) How many puncheons of rum, at 16*s.* 6*d.* *per gallon*, can I have for 485*l.* 2*s.* 2*d?*

(16) Gave 16*l.* 1*s.* 9*d.* for 4*doz.* and 6 pairs of silk gloves, required the value of 13½ dozen pairs.

(17) When wheat is at 43*s.* a load of 16 score pounds, what is the price of the measure weighing 70*lb?*

(18) If 100*l.* gain 4*l.* 10*s.* interest in 19 months, what will it gain in 27 months?

(19) How many pieces of calico, each 28 yards, at 20½*d.* *per yard*, can I have for 11*l.* 19*s.* 2*d?*

(20) Bought 9 bags of hops, each 3*cwt.* 1*qr.* 26*lb.* at 5½ guineas *per cwt*, what will 83*lb.* come to at that rate?

(21) Required the interest of 754*l.* 16*s.* 8*d.* for 6¼ years, at 4½*l.* *per cent.*

(22) Bought 5 casks of sugar, each 6*cwt.* 3*qr.* 15*lb.* gross, tare 32*lb.* *per cask*, at 88*s.* 7*d.* *per cwt*, what does it come to?

(23) Required the value of a bag of cotton, weighing 4*cwt.* 3*qr.* 19*lb*, at 3*s.* 6¾*d.* *per lb.*

(24) At 7½ guineas *per cwt*, what will 11 bags of cotton come to, each weighing 2*cwt.* 1*qr.* 27*lb?*

(25) Required the value of 17 boxes of soap, each containing 3*cwt.* 3*qr.* 23*lb*, at 8*s.* 4½*d.* *per dozen.*

(26) If 100*l.* gain 4*l.* 15*s.* interest in 12 months, what will 559*l.* 19*s.* 11¾*d.* gain in that time?

(27) If 45*s.* be paid for the carriage of 41*cwt.* 12 miles, what must be paid for the carriage of 5¾ tons the same distance?

(28) If 3½ guineas be paid for the carriage of 42*cwt.* 25½ miles, how far may 126*cwt.* be carried for the same money?

(29) At 12*s.* 8*d.* *per stone* of 15*lb*, what will 23 packs of wool come to, each pack weighing 14 score and 10 pounds?

(30) Gave 65*s.* 6*d.* *per cwt.* for 15*cwt.* 2*qr.* 29*lb.* of cheese, and paid 2*s.* 4*d.* *per cwt.* for carriage, what does the cheese cost me?

(31) Find the value of 17 reams of paper, at 10½*d.* *per quire.*

(32) At 26*s.* 6*d.* *per thousand*, what will one hundred thousand bricks come to?

(33) What will 7 casks of madder come to at 97*s.* 8¼*d.* *per cwt*, each cask 5*cwt.* 3*qr.* 19*lb?*

(34) How many yards of cloth may be bought for 27*l.* 11*s.* when ¾ of a yard cost 12*s.* 6*d?*

(35) If 35¾ yards of cloth cost 4½ guineas, what quantity may I have for 150 guineas?

(36) At 3*l. per oz.* I paid 594*l.* 4*s.* for a piece of gold, required its weight.

(37) When 200*l.* buy 70*cwt.* 1*qr.* 25*lb.* of madder, what quantity can I have for 45*l?*

(38) What will 3*qr.* 2*nls.* of cambric come to, at 17*s.* 9*d. per yard?*

(39) I lent a friend 350*l.* for 13 months, how long ought he to lend me 612*l.* 10*s.* to return the favour?

(40) What sum ought my friend to lend me 15 months, for the loan of 250 guineas 6 months?

(41) How many pounds of coffee at 4*s.* 8*d. per pound*, are equal in value to 338$\frac{1}{4}$*lb.* of tea, at 6*s.* 9*d. per pound?*

(42) How many pounds of cotton twist at 2*s.* 4$\frac{3}{4}$*d. per lb*, are equal in value to 5 pieces of velveteen, each 42 yards, at 4*s.* 3*d. per yard?*

(43) If 24 men can mow 480 acres in 28 days, in how many days will 8 men mow 40 acres?

(44) At 6*s.* 6*d. per ell Flemish*, what will 456*yds.* 3*qrs.* 2*nls.* of cloth come to?

(45) What will 78*cwt.* 8*lb.* of coffee come to, when 2$\frac{1}{2}$*lb.* cost 6*s.* 3*d*?

(46) What quantity of butter can I have for 105*l.* 8*s.* 6*d*, when 88*l.* 16*s.* 8*d.* will purchase 95*cwt.* 20*lb*?

(47) A person failing owes me 362*l.* 19*s.* 6*d*, how much shall I receive at 8*s.* 4*d. per pound?*

(48) A ship is valued at 3540*l*, what is the value of $\frac{5}{12}$ of it?

(49) If the carriage of a ton weight 50 miles cost 5*l.* 10*s*, how far may 45*cwt.* 3*qr.* 14*lb.* be carried for 26*l.* 5*s.* 6*d*?

(50) Required the value of 11 casks of oil, each 109$\frac{1}{2}$ gallons, at 10$\frac{1}{4}$*d. per pint.*

(51) Find the value of 14$\frac{1}{2}$ yards of cloth, when 65 *ells English* cost 23*l.* 5*s.* 6*d.*

(52) If 13$\frac{1}{2}$*cwt.* be carried 55 miles for 3*l.* 14*s.* 3*d*, what weight can I have carried 185$\frac{1}{4}$ miles for the same money?

(53) When gum is 94*s.* 6*d. per cwt*, what will 5 casks come to, each 5*cwt.* 2*qr.* 23*lb?*

(54) A gentleman's income is 510*l.* 8*s.* 4*d.* a year, how much may he spend a day, and lay up a hundred guineas a year?

(55) Find the value of 13 chests of tea, each 86$\frac{1}{2}$*lbs.* at 6*s.* 2$\frac{1}{2}$*d. per pound.*

(56) A house lets for 120 guineas a year, what will the poor-rates come to, at 5*s.* 6*d.* in the pound?

(57) What will 256*cwt.* 3*qr.* 14*lb.* of butter come to, when 1$\frac{1}{2}$*cwt.* cost 45*s.* 7*d*?

(58) How many stones of hay will keep 9 horses 12 weeks, when 14 horses eat 98 stones in 7 days?

(59) What will $56\frac{1}{2}$ yards of cloth cost, when 4 pieces, each $40\frac{3}{4}$ yards, cost 35*l.* 9*s.* 8*d?*

(60) Bought $451\frac{1}{4}$ gallons of rum, at 13*s.* 6*d. per gallon*, which I sold at 14*s.* 9*d. per gallon*, what did I gain by it?

(61) If 200*l.* principal, gain 9*l.* 10*s.* in 12 months, what principal will gain the same interest in $7\frac{1}{2}$ months?

(62) Bought 7 boxes of soap, each 3*cwt.* 1*qr.* 9*lb.* at 8*s.* 3*d. per dozen*, what do they come to?

(63) If 8 men earn 7*l.* 10*s.* in 9 days, in what time will 14 men earn the same sum?

(64) Bought 3 puncheons of rum, at $54\frac{1}{2}$ guineas a puncheon, carriage cost 17*s.* 6*d.* a puncheon, what does 1 gallon cost me?

(65) How much tape at 3 yards for 2*d*, will purchase a bag of cotton weighing 3*cwt.* 2*qr.* 15*lb.* worth $19\frac{1}{2}d.$ *per pound?*

(66) Bought 6 casks of sugar, each 2*cwt.* 3*qr.* 19*lb.* at 57*s.* 6*d. per cwt*, for how much must I sell one cask to gain 8*l.* 17*s.* 6*d.* by the whole?

(67) What ought the shilling loaf to weigh when wheat sells at 63*s.* 6*d. per sack*, if it weigh 4*lb.* 1*dr.*, when wheat sells at 40*s.* 4*d. per sack?*

(68) Required the value of 17 pieces of gingham, each $56\frac{1}{2}$ yards, at 2*s.* $1\frac{1}{2}d.$ *per yard.*

(69) A garrison, consisting of 500 men, has provisions for 6 weeks, but finding that they will be obliged to continue 15 weeks without an additional supply of provisions, how many must be sent out, that the provisions may serve the remainder 15 weeks?

(70) A staff 5 feet long gives a shadow 7*ft.* 3*in.*, what length of a shadow does a steeple give, which is 40 yards high?

(71) Bought 42 pieces of cloth, each $26\frac{1}{2}$ yards, for 60*l.* 5*s.* 6*d.*, for how much must I sell $8\frac{1}{2}$ yards, to gain 7*l.* 10*s.* by the whole?

(72) Bought in Jamaica 6 puncheons of rum, at 3*s.* 2*d. per gallon*, freight 2 guineas per puncheon, duty 7*s.* 3*d.* a gallon, what does a gallon cost?

(73) Six yards and a quarter of a yard wide cloth will make a cloak, how much shalloon, half yard wide, will line it?

(74) Bought a quantity of cotton for 235*l.* 16*s.* $0\frac{1}{2}d.$ at $23\frac{3}{4}d.$ *per lb*, required the quantity.

(75) Bought $360\frac{1}{2}$*cwt.* of tobacco for 750*l.* 5*s*, for how much must I sell $3\frac{3}{4}$*cwt.* to clear 76*l.* by the whole?

(76) Paid 6*l.* 18*s.* 6*d.* for the carriage of 48*cwt.* 14*lb.* the distance of 72 miles, how far may the same weight be carried for 25*l.* 10*s*?

(77) Gave $5\frac{1}{2}$ guineas for a ton of hay, which I sold again at

$10\frac{1}{4}d.$ *per stone* of 16*lb*, what did I gain or lose by it, 120*lb*. to the *cwt*?

(78) Gave 7*s*. 6*d*. for a dozen slates, which I sold again for 9*s*. 3*d*, what should I gain by trading to the amount of 100*l*?

(79) Sold 5 bags of cotton, each 2*cwt*. 3*qr*. 26*lb*. at 2*s*. $7\frac{1}{2}d.$ *per lb*, and gain 31*l*. 2*s*. 6*d*. by it, what did it cost me?

(80) If 8 men earn 7*l*. 10*s*. in 9 days, in what time would 14 men earn 37*l*. 10*s*?

(81) At $8\frac{1}{4}d.$ *per pound*, required the value of 47 dozen in pounds of candles.

(82) Sold 39*cwt*. 2*qr*. 17*lb*. of coffee, at 7*l*. 19*s*. 4*d*. *per cwt*, and lost 24*l*. 9*s*. 10*d*. by it, what did it cost?

(83) Required the value of 41 pigs of lead, each 3*qr*. 6*lb*, at 16*s*. 9*d*. *per cwt*.

(84) Gave 118*l*. 5*s*. for 53 pieces of dimity, at 18*d*. *per yard*, how many yards were there in each piece?

(85) At 3*s*. 4*d*. in the pound, the taxes of an estate come to 25*l*. what is the annual value of the estate?

(86) A tradesman owes 3632*l*. 16*s*. 8*d*, and his property amounts to 1362*l*. 6*s*. 3*d*, how much will he pay in the pound?

(87) When a man travels 14 hours in a day, he can perform a journey of 180 miles in 5 days, in what time will he perform the same journey, if he travel 16 hours a day?

(88) Bought 425*cwt*. 3*qr*. 16*lb*. of hops, and by selling them at 9 guineas *per cwt*, I found my gain was 58*l*. 10*s*, what was the prime cost?

(89) Bought $245\frac{1}{4}$ yards of cloth for 35*l*. 6*s*. 9*d*, and I wish to gain 5 guineas by it, how must I sell it per yard?

(90) The sum of 1560*l*. 15*s*. will gain 51*l*. 10*s*. in 8 months, in what time will 690*l*. 12*s*. 6*d*. gain the same interest?

(91) Bought 27*cwt*. 3*qr*. 15*lb*. of cotton for 304*l*. 15*s*. 6*d*, for how much must I sell 1*lb*. to lose no more than 20 guineas by the whole?

(92) If 252 acres of grass be mowed by 14 men in 24 days, in how many days will 32 men mow 144 acres?

(93) If 80 guineas will maintain 12 persons 3 months, how many persons will 252*l*. maintain for a year?

(94) What will 42*cwt*. 2*qr*. 11*lb*. of tobacco come to, when 14*cwt*. 1*qr*. 5*lb*. cost 17*l*. 9*s*. $8\frac{1}{4}d$?

(95) How many yards of calico, worth 16*d*. a yard, must be given for 7*cwt*. 2*qr*. 16*lb*. of coffee, at $21\frac{1}{2}d.$ *per pound*?

(96) What quantity of sugar at $7\frac{3}{4}d.$ *per pound*, can I have for 575 guineas?

(97) Bought 5 casks of gum, each 5*cwt*. 3*qr*. 22*lb*. at 75*s*. 9*d*. *per cwt*, paid carriage 8*s*. 5*d*. *per cwt*, what do they come to?

(98) Find the value of 65*cwt.* 3*qr.* 27*lb.* of cheese, at 71*s.* 6*d.* *per cwt.*

(99) What will 6 bags of coffee, each 2*cwt.* 3*qr.* 15*lb.* come to, at $21\frac{1}{4}d.$ *per pound?*

(100) When wheat was sold at 42*s.* 8*d.* *per load,* I gave $12\frac{1}{2}d.$ for a loaf, what was the price of a load of wheat when a loaf of the same weight cost $17\frac{3}{4}d$?

(101) A and B have failed, and will pay 5*s.* $8\frac{3}{4}d.$ in the pound, my debt is 271*l.* 13*s.* 5*d,* how much shall I lose?

(102) Find the interest of 691*l.* 19*s.* 10*d.* for 4 months and 24 days, at $4\frac{3}{4}l.$ *per cent.*

(103) Gave 3*l.* 10*s.* a load for 12 loads of flour, for how much must I sell the whole to gain 21*l.* *per cent?*

(104) What weight may be carried $47\frac{5}{6}$ miles for 7*l.* 5*s.* 6*d,* when 36*cwt.* 3*qr.* 13*lb.* is carried $10\frac{1}{6}$ miles for the same money?

(105) Bought 3*cwt.* 3*qr.* 16*lb.* of madder, at 98*s.* 7*d.* *per cwt;* 7*cwt.* 1*qr.* 21*lb.* at 101*s.* 10*d.* *per cwt;* 9*cwt.* 2*qr.* 23*lb.* at 102*s.* 11*d.* *per cwt,* at 6 months' credit, what ought I to have deducted on paying present bill?

(106) Required the interest of 385*l.* 15*s.* for 7 years and 9 months, at $4\frac{1}{4}l.$ *per cent.*

(107) When sugar is $10\frac{1}{2}d.$ *per pound,* how must I sell it *per cwt,* to gain 15*l.* *per cent?*

(108) $56\frac{1}{2}$ at $5\frac{1}{4}d;$ $31\frac{1}{4}$ at $4\frac{1}{2}d;$ $37\frac{3}{4}$ at $5\frac{1}{2}d;$ $41\frac{1}{4}$ at $5\frac{3}{4}d;$ $43\frac{1}{2}$ at $7\frac{1}{4}d;$ $44\frac{3}{4}$ at $6\frac{1}{4}d.$

(109) $55\frac{1}{4}$ at $6d;$ $82\frac{3}{4}$ at $6\frac{1}{2}d;$ $91\frac{1}{4}$ at $6\frac{3}{4}d;$ $105\frac{1}{2}$ at $7d;$ $55\frac{1}{4}$ at $5\frac{1}{2}d;$ $29\frac{1}{2}$ at $7\frac{3}{4}d.$

(110) $38\frac{3}{4}$ at $7\frac{1}{4}d;$ $40\frac{1}{4}$ at $7\frac{1}{2}d;$ $45\frac{1}{2}$ at $8\frac{3}{4}d;$ $57\frac{3}{4}$ at $8\frac{1}{2}d;$ $83\frac{3}{4}$ at $8\frac{1}{4}d;$ $94\frac{1}{2}$ at $8d.$

(111) Sold 41*cwt.* 3*qr.* 19*lb.* of tobacco, at 5*l.* 7*s.* 6*d.* *per cwt,* and gained 30 guineas by it, what did it cost?

(112) If 3 pipes of wine cost 20 guineas a pipe, what is the cost of one gallon?

(113) When wheat sells at 8*s.* 9*d.* a measure of 70*lb,* what will 50 loads come to, each 16 score?

(114) What will be the value of 41 pieces of woollen cloth, each $56\frac{1}{2}$ yards, when $13\frac{1}{4}$ yards of the same is worth 56*s.* 8*d?*

(115) I lost 45*l.* 19*s.* 6*d.* by selling 13 bags of cotton, each 3*cwt.* 1*qr.* 9*lb.* for 315*l.* 16*s.* 10*d,* what did it cost me *per pound?*

(116) How much shalloon 3*qr.* of a yard wide, will line a cloak which takes 5 yards of cloth, yard wide?

(117) Paid 44*s.* 6*d.* *per cwt,* for 13*cwt.* 1*qr.* 19*lb.* of treacle, freight 41*s.* a ton, porterage 4*s.* 6*d,* what does it come to?

(118) $98\frac{1}{4}$ at $9\frac{1}{4}d;$ $102\frac{3}{4}$ at $9\frac{3}{4}d;$ 59 at $9\frac{1}{2}d;$ 77 at $10\frac{1}{4}d;$ 79 at $10\frac{1}{2}d;$ 85 at $10\frac{3}{4}d.$

(119) 87 at $11\frac{3}{4}d$; 83 at $11\frac{1}{2}d$; 95 at $12\frac{3}{4}d$; 98 at $11\frac{1}{4}d$; 103 at $12\frac{1}{2}d$; 107 at $13\frac{1}{4}d$.

(120) 109 at $13\frac{1}{2}d$; 113 at $12\frac{1}{4}d$; $76\frac{1}{2}$ at $13\frac{3}{4}d$; $31\frac{1}{4}$ at $14\frac{1}{2}d$. $23\frac{3}{4}$ at $14\frac{1}{4}d$; $26\frac{1}{2}$ at $14\frac{3}{4}d$.

(121) What sum will gain 127*l*. 1*s*. $0\frac{1}{4}d$. in 7 years and 9 months, at $4\frac{1}{4}l$. *per cent*, *per annum?*

(122) I lost $35\frac{3}{4}$ guineas by selling 161*cwt*. 2*qr*. 17*lb*, at 79*s*. $4\frac{1}{2}d$. *per cwt*, what did a pound cost me?

(123) Required the value of 8 casks of soap tallow, at 69*s*. 8*d*. *per cwt*. No. IV, 9*cwt*. 3*qr*. 19*lb*; No. V, 9*cwt*. 3*qr*. 1*lb*; No. VI, 10*cwt*. 0*qr*. 17*lb*; No. VII, 9*cwt*. 2*qr*. 26*lb*; No. VIII, 9*cwt*. 3*qr*. 16*lb*; No. IX, 9*cwt*. 2*qr*. 11*lb*; No. X, 9*cwt*. 3*qr*. 25*lb*; No. XI, 9*cwt*. 1*qr*. 27*lb*; tare 12*lb*. *per cwt*.

(124) What will 671*cwt*. 3*qr*. 23*lb*. come to, when 14*cwt*. 1*qr*. 23*lb*. cost 58*l*. 14*s*. $9\frac{1}{4}d$?

(125) In what time will 754*l*. 16*s*. 8*d*. gain 212*l*. 5*s*. 10*d*, at $4\frac{1}{2}l$. *per cent*, *per annum?*

(126) Find the value of 6 bales of Surat cotton wool, at $17\frac{1}{4}d$. *per lb*. net; No. VII, 3*cwt*. 1*qr*. 15*lb*; No. VIII, 3*cwt*. 2*qr*. 16*lb*; No. IX, 3*cwt*. 3*qr*. 7*lb*; No. X, 3*cwt*. 2*qr*. 19*lb*; No. XI, 2*cwt*. 3*qr*. 26*lb*; No. XII, 2*cwt*. 3*qr*. 23*lb*; tare 19*lb*. *per bale*.

(127) $17\frac{3}{4}$ at $15\frac{3}{4}d$; $19\frac{1}{2}$ at $15\frac{1}{4}d$; $34\frac{1}{4}$ at $16\frac{1}{2}d$; $82\frac{1}{2}$ at $16\frac{3}{4}d$; $97\frac{3}{4}$ at $17\frac{1}{2}d$; $98\frac{1}{2}$ at $17\frac{3}{4}d$.

(128) $102\frac{1}{4}$ at $17\frac{1}{4}d$; 1056 at $18\frac{1}{4}d$; 9042 at $18\frac{1}{2}d$; 7568 at $18\frac{3}{4}d$; 4592 at $19\frac{1}{2}d$; 7567 at $19\frac{3}{4}d$.

(129) 9456 at 19*d*; 8576 at $20\frac{3}{4}d$; 8567 at $20\frac{1}{4}d$; 9431 at $20\frac{1}{2}d$; 8145 at 20*d*; 3578 at 21*d*.

(130) 6942 at $21\frac{1}{4}d$; $7674\frac{1}{2}$ at 22*d*; $9678\frac{3}{4}$ at $22\frac{3}{4}d$; $7067\frac{1}{4}$ at $23\frac{1}{4}d$; $5161\frac{1}{2}$ at $22\frac{1}{4}d$; $4964\frac{3}{4}$ at $22\frac{1}{2}d$.

(131) Required the value of 47 pigs of lead, each 3*qr*. 1*lb*. 5*oz*. 13*drs*, when 5*cwt*. $3\frac{1}{2}qr$. cost $4\frac{3}{4}$ guineas.

(132) When 3*cwt*. 3*qr*. $15\frac{1}{4}lb$. of indigo cost 119*l*. 19*s*. $11\frac{1}{2}d$, what will be the value of 29 *tons* 13*cwt*. 3*qr*. $19\frac{1}{2}lb$?

(133) When a bag of cotton, weighing 3*cwt*. 2*qr*. $26\frac{1}{2}lb$, cost 18*l*. 19*s*. $11\frac{1}{2}d$, what will 15 bags come to, each 3*cwt*. 2*qr*. $27\frac{3}{4}lb$?

(134) What will 15*hhds*. of sugar cost, each 8*cwt*. 2*qr*. 11*lb*. 10*oz*. 12*drs*, when 4*cwt*. 1*qr*. 15*lb*. cost 21 guineas?

(135) When 5 *tons* 13*cwt*. 3*qr*. 12*lb*. 11*oz*. 10*drs*. of copper cost 695*l*. 19*s*. $11\frac{3}{4}d$, what weight can I have for 1295*l*. 13*s*. $9\frac{1}{2}d$?

(136) A person fails whose effects amount to 95671*l*. 1*s*. 10*d*, he owes 90763*l*. 16*s*. 9*d*, how much can he pay in the pound?

(137) Required the interest of 599*l*. 16*s*. $11\frac{3}{4}d$, for 5, 7, 11, 10, and 48 months, at 5*l*. *per cent*.

(138) What is the interest of 3016*l.* 11*s.* 5½*d* for 7 years, 7 months, and 20 days, at 4¾*l. per cent?*

(139) What is the interest of 7206*l.* 19*s.* 9½*d*, at 4½*l. per cent*, for 5 months 18 days, for 8 months 25 days, and 11 months 21 days?

(140) Required the interest of 3976*l.* 16*s.* 9*d*, for 61, 71, 83, 95, 111, and 133 days, at 4¼*l. per cent.*

(141) Sold 2 pieces of cloth, each 28 yards, for 12 guineas, but one piece came to 2*l.* 4*s.* more than the other, what was each piece sold for *per yard?*

(142) If 60*cwt.* be carried 20 miles for 4*l.* 10*s*, what weight ought to be carried 30 miles for 5*l.* 8*s.* 9*d?*

(143) How many roods of ditching can be done by 8 men in 4 days, working 9 hours a day, when 3 men in 16 days of 15 hours can do 18 roods?

(144) When wheat is 87*s. per load*, the quartern loaf of 4*lb.* 5*oz.* cost 18½*d*, what will it cost when wheat is 33*s.* 6*d. per load?*

(145) What will be the value of 18*cwt.* 1*qr.* 26¼*lb.* of sugar, when 14¾*cwt.* cost 79*l.* 16*s?*

(146) Bought 6 loads of peas at 18*s.* 4*d. per load;* 8 loads of beans at 22*s.* 9*d;* 27 loads of wheat at 35*s.* 7*d. per load;* I mixed them, and wish to know how I must sell the mixture *per load* to gain 24½*l. per cent?*

(147) Sold 50 pieces of cloth, each 33 *ells Flemish*, at 9*s.* 6*d. per ell English*, what do they come to?

(148) Bought in America goods amounting to 654*l.* 9*s.* currency, how much must I remit, exchange being 32*l. per cent?*

(149) When wheat is 37*s. per load*, the shilling loaf weighs 6*lb.* 9*oz*, what ought it to weigh when wheat is 55*s. per load?*

(150) By selling tea at 10*s. per pound*, I gain 33*l.* 6*s.* 8*d. per cent*, what did a pound cost me?

(151) At what rate *per cent*, will 643*l.* 2*s.* 6*d.* amount to 787*l.* 16*s.* 6¾*d.* in 5 years?

(152) Bought 2 bags of cotton, each 3*cwt.* 2*qr.* 19*lb.* gross, tare 2½*lb.* in 70*lb*, at 2*s.* 9¼*d. per lb;* I sold them again at 3*s.* 0½*d. per lb*, and allowed for tare 1¾*lb.* for 80*lb*, what was my gain?

(153) How many puncheons of rum, at 8*s.* 9*d. per gallon*, must be given for 25 pieces of fustian, each 42½ yards, at 2*s.* 1*d. per yard*, and 61 pieces of muslinet, each 52¾ yards, at 17¼*d. per yard?*

(154) If 336 men in 5 days, of 10 hours each, dig a trench 70 yards long, 3 wide, and 2 deep; what length of trench 5 yards wide and 3 deep, may be dug by 240 men in 9 days, of 12 hours each?

(155) Bought 4 casks of gum, each 4*cwt.* 1*qr.* 27*lb.* gross, tare 27½*lb. per cask*, at 175*s. per cwt*, by the sale of it I gained 25*l. per cent*, what did I gain by the whole?

(156) A, B, and C, enter into partnership, A put in 1000*l*, B 1500*l*, and C 2800*l;* at the end of 8 months, A put in 500*l*. more; at the end of 6 months, B took out 375*l;* C took out 600*l*. at the end of 3 months, but at the end of 5 months he put in 1380*l;* at the year's end their gain was 792*l*. 10*s*, required the share of each.

(157) How much in length of a board, that is 8 inches broad, will make a square foot?

(158) Required the interest of 267*l*. 13*s*. 9*d*. for 5, 7, 8, 10, 11, 13, 17, and 19 months, at 4¾*l. per cent*, simple interest.

(159) If by selling goods at 2*s*. 3*d*. *per pound*, I clear *cent per cent*, what do I clear *per cent* by selling them at 9 guineas *per cwt?*

(160) Paid 18*l*. 14*s*. 11*d*. for purchasing goods to the amount of 3745*l*. 18*s*. 6*d*, how much is it *per cent?*

(161) If 18 *tons*, 15*cwt*. of iron be sold for 490*l*, and the gain upon it be 20*l. per cent*, what did 1*cwt*. cost?

(162) If 90 *Flemish ells* of cambric cost 60*l*, how must I sell it *per yard* to gain 18*l. per cent?*

(163) How many men will make a fortification in 8 days, working 17 hours a day, when 222 men can do it in 13 days, working 11 hours a day?

(164) In 9 jars of oil, each 4*cwt*. 1*qr*. 11*lb*. gross, tare 19*lb. per cwt*, trett and cloff as usual, how many neat gallons?

(165) In what time, at any rate *per cent*, will the interest of 55*l*. 14*s*. equal the interest of 17*l*. 9*s*. 6*d*, which was lent 35 days?

(166) Paid 69*l*. for a ton of steel, which was retailed at 6*d*. *per lb*, what would be the gain or loss by the sale of 14 tons?

(167) By selling 125*oz*. 9*dwt*. 17*grs*. of silver, at 5*s*. 4*d*. *per oz*, I lost 11¾*l. per cent*, what did I lose by the whole quantity?

(168) A garrison of 7200 men has employment for 8 months, but by increasing the number of men, they can finish their work in 6 months, required the number to be added.

(169) Sold a horse for 40*l*. and lost 20*l*. *per cent* by him, but I ought to have cleared 30*l*. *per cent* by him, how much was he sold under his value?

(170) What money at 3½*l*. *per cent*, will gain 38*l*. 10*s*. in a year and a quarter?

(171) What quantity of American potashes at 39*s*. 8*d*. *per cwt*. currency, may I have for 44 pieces of broad cloth, each 34½ yards, at 16*s*. 3*d*. *per yard*, and 22 pieces of narrow cloth, each 55¾ yards, at 6*s*. 4*d*. *per yard*, exchange 33¼*l*. *per cent?*

(172) A family of 60 persons have provisions for 25 days, but they are required to serve them 30 days, how must matters be regulated?

(173) Sold 17*cwt.* 3*qr.* 21*lb.* of madde at 6*l. per cwt*, and gained 25*l. per cent* by it, what did the whole cost me, and what *per cwt?*

(174) By selling hops at 135*s. per cwt*, I cleared 25*l. per cent*, how much should I have cleared *per cent*, if I had advanced the price of a *cwt.* 25*s?*

(175) Bought cloth at 7*s.* 6*d. per yard*, which being damaged, I must lose 17½*l. per cent* by it, how must I sell it *per yard?*

(176) If a family drink 25*s.* worth of wine a week, when it is 45*l.* 10*s.* 6*d.* a pipe, how much will their wine cost a year, when it is 63 guineas a pipe?

(177) A merchant failing, owes to A 1542*l.* 17*s.* 6*d*, to B 1393*l.* 15*s.* 8*d*, to C 542*l.* 16*s.* 4*d;* his effects amount to 579*l.* 18*s.* 3*d*, how much will each receive, and how much in the pound?

(178) A tradesman fails in 7240*l.* 16*s.* 6*d*, and his property amounts to 4691*l.* 14*s.* 5*d*, how much will that creditor receive to whom he owes 597*l.* 17*s.* 3*d?*

(179) A tradesman fails in 8241*l.* 16*s.* 2*d*, and at one time pays 3*s.* 8½*d.* in the pound, at another 2*s.* 7¼*d*, how much does he pay in the whole?

(180) When the day is 17 hours long, 54 men can do a piece of work in 18 days, in how many days of 9 hours long, will 68 men do the same?

(181) A has 123 pieces of cloth worth 42*s.* 6*d.* each, ready money, which he values at 47*s.* 3*d.* each, in exchange with B for tobacco, worth 7*l.* 14*s.* 9*d.* ready money; how ought B to value his tobacco, and how many cwt. ought he to give A?

(182) Bought 4 fothers of lead, at 2½*d. per lb*, which I sold again at 3*s.* 2½*d. per cwt.* loss, how much did I lose by the whole?

(183) Sold 16*cwt.* 3*qr.* 21*lb.* of nut galls, at 11½ guineas *per cwt*, and lost 8¾*l. per cent* by them, what did I lose by the whole?

(184) By selling shoes at 5*s.* 9*d.* a pair, I lost 6¼*l. per cent*, how must I sell them a pair to gain 24¾*l. per cent?*

(185) A young person had a fortune of 2500*l*, which continued 8 years in his guardian's hands, at which time he received 3500*l*, what was the rate of interest?

(186) Sent to Barbadoes 1 chest at 250*l;* 2 trunks 362*l;* 1 crate of china 155*l.* 15*s.* 5*d;* 57 hams, weighing 8*cwt.* 3*qr.* 14*lb*, at 8*d. per lb;* freight 32*l.* 5*s.* charges of shipping, &c. 2*l.* 5*s.* 6*d;* insurance of the above amount, 15*s. per cent;*

how much cotton may I receive for the above, at $22\frac{1}{4}d.$ *per lb?*

(187) Bought in Virginia 6*hhds.* of tobacco, weighing 25 *cwt.* 3*qr.* 5*lb.* gross, tare 2*qr.* 16*lb. per hhd,* at $2\frac{3}{4}d.$ *per lb.* currency, exchange 42*l. per cent;* freight paid here 15*s. per hhd,* duty 17*d. per lb,* manufacturing 1*d. per lb,* what did I gain by selling it at 2*s.* 4*d. per lb?*

(188) A tower 384 feet high from its foundation, $\frac{1}{6}$ part of it is in the ground, and $\frac{1}{8}$ part in the water, how much in height is visible?

(189) A merchant bought 8 pipes of wine, which he was obliged to sell for 400*l,* at a loss of 20*l. per cent,* what did a pipe cost him, and for how much did he sell it *per gallon?*

(190) A person dying, left his widow 70*l.* a year, and to his son John 1850*l,* to James 1730*l,* to Thomas 1680*l,* he had 330 guineas to begin with, and had been $17\frac{1}{4}$ years in business, how much did he clear *per annum?*

(191) A regiment of 720 men are in a garrison, with provisions for 6 months; but they find that two-thirds of the number can do the work, how much longer will the provisions serve those that continue?

(192) A lottery ticket cost 8*l.* 16*s,* and three men joined at two-thirds of it, it proved a prize of 2000*l,* required each man's share.

(193) A piece of land is 80 yards long and 70 yards broad, how many parcels will it make, each 20 yards long and 14 yards broad?

(194) I gained $6\frac{1}{4}l.$ *per cent.* by selling sugar at $7\frac{3}{4}d.$ *per pound,* how must I sell it *per pound* to gain $9\frac{3}{4}l.$ *per cent?*

(195) A ship's crew, consisting of 98 men, took a prize valued at 2560*l,* the captain's share was one-fifth, and the remainder was equally divided among the men, how much did each receive?

(196) A father left 2280*l.* to be divided among 4 sons, whose shares were to be in proportion of 3, 4, 5, and 6, required the share of each. Also, how much must each have if the first take one-third, the second one-fourth, the third one-fifth, and the fourth one-sixth?

(197) Bought 44 pieces of broad-cloth, each $33\frac{3}{4}$ yards, at 18*s.* 4*d. per yard,* and 54 pieces plain, each $50\frac{1}{4}$ yards, at 5*s.* 7*d. per yard,* they are to be paid for at three equal payments, at 4, 8, and 12 months, how much shall I have deducted on paying present bill, discount 5*l. per cent?*

(198) At what rate *per cent.* will 620*l.* amount to 793*l.* 12*s.* in 7 years?

(199) At 5*l. per cent,* I received 15*s.* for the loan of 20*l,* required the time.

(200) At what rate *per cent.* will 100*l.* double itself in 20 years?

(201) I gained 8*l. per cent.* by selling 12 yards of cloth for 5*l.* 14*s*, what did a yard cost?

(202) Lent a sum of money for $7\frac{3}{4}$ years, at $3\frac{1}{4}$*l. per cent*, for which I received 219*l.* 8*s.* $1\frac{1}{2}$*d.* required the sum lent.

(203) Borrowed on the 10*th* of May, 60*l.* 10*s*, I paid it again on the 26*th* of Dec. following, required the interest at $3\frac{1}{2}$*l. per cent.*

(204) Suppose I lose 9*l. per cent* by selling 500 yards of cloth, at 15*d. per yard*, what do I lose by the whole?

(205) A person bought goods for me, amounting to 350*l.* 16*s.* 8*d*, what must I pay him for his trouble, at $8\frac{3}{4}$*d. per pound?*

(206) Required the interest of 594*l.* 19*s.* $10\frac{1}{4}$*d*, at 5*l. per cent*, from the 25*th* of Dec. 1845, to the 5*th* of April, 1846; from the 12*th* of Jan. 1846, to the 13*th* of May; from the 25*th* of August, 1845, to the 25*th* of March, 1846.

(207) Required the amount of 150*l.* for 5 years, at 4*l. per cent*, compound interest.

(208) In what time will 200*l.* gain 1*l.* 8*s*, at $3\frac{1}{2}$*l. per cent?*

(209) What is the amount at 5*l. per cent.* of 340*l.* 10*s*, from the 1*st* of January, 1846, to the 18*th* of July following?

(210) What is the interest of 500*l*, from the 4*th* of Dec. 1845, to the 10*th* of March, 1846, at 4*l. per cent?*

(211) Find the net interest on May 7*th*, 1846, of 8 Exchequer bills, of 100*l.* each, date August 22*nd*, 1845, interest of one bill $3\frac{1}{2}$*d. per day.*

(212) Required the interest of 391*l.* 16*s.* 5*d*, from the 3*rd* of Jan. to 13*th* of October following; also of 253*l.* 4*s.* 9*d*, from March 5*th* to 29*th* of January following, at $4\frac{1}{2}$*l.* and 5*l. per cent.*

(213) Required the interest of 1000*l*, from the 3*rd* of April, 1845, to the 3*rd* of January following, at 5*l. per cent.*

(214) Bought 20 chaldrons of coals for 30*l*, and sold them for 37*l.* 10*s*; but if they had cost 37*l.* 10*s*, how must I have sold them to have gained after the same rate?

(215) Sold hops at 3*s.* 6*d. per lb*, and gained 75*l. per cent*, what did they cost me *per pound* and *per cwt?*

(216) Jacob has 41*cwt.* 3*qr.* 15*lb.* of hops, at 5*l.* 3*s.* 6*d. per cwt*, for which Moses gives him 54*l.* 5*s.* 6*d*, and the balance in sugar at $8\frac{1}{4}$*d. per lb.* Query the quantity.

(217) If a board, 5 inches broad and $28\frac{4}{5}$ inches long, make a square foot, how many inches broad will make a square foot when the length is 12 inches?

(218) If 9*oz.* of bread cost a halfpenny *per ounce* when corn is 6*s.* 6*d. per bushel*, what must be paid for 3*lb.* 4*oz*, when corn is 8*s.* 2*d. per bushel?*

(219) Two persons A and B enter into partnership; A advanced a certain number of piastres, and B put in 60*l*;

they gained 202*l.* 10*s*, of which B's share was 90*l*; how many did A advance, at 4*s.* 2*d. per piastre?*

(220) A grocer bought 96*lb.* of tea for 38*l*, how must he sell it *per ounce* to gain 12*l.* at laying out 80*l?*

(221) Find the value of $9613\frac{1}{4}$ at $23\frac{1}{2}d$; $7635\frac{1}{2}$ at $23\frac{1}{4}d$; $5163\frac{1}{4}$ at 2*s*; $5054\frac{1}{2}$ at 2*s.* $0\frac{1}{4}d$; $6345\frac{3}{4}$ at 2*s.* $0\frac{1}{2}d$; $7140\frac{1}{4}$ at 2*s.* $0\frac{3}{4}d$.

(222) Required the value of 17654 at 2*s.* 1*d*; $18567\frac{1}{4}$ at 2*s.* $1\frac{1}{2}d$; $97654\frac{3}{4}$ at 2*s.* $1\frac{1}{4}d$; $7945\frac{1}{2}$ at 2*s.* $1\frac{3}{4}d$; $8546\frac{1}{2}$ at 2*s.* 2*d*; $7645\frac{1}{4}$ at 2*s.* $2\frac{1}{4}d$.

(223) What will be the value of $6745\frac{3}{4}$ at 2*s.* $2\frac{3}{4}d$; $7635\frac{1}{2}$ at 2*s.* 3*d*; $1905\frac{1}{4}$ at 2*s.* $3\frac{1}{4}d$; $7050\frac{3}{4}$ at 2*s.* $3\frac{3}{4}d$; $4454\frac{1}{2}$ at 2*s.* $3\frac{1}{2}d$; $6542\frac{3}{4}$ at 2*s.* $2\frac{1}{2}d$*?*

(224) Find the value of $7968\frac{1}{2}$ at 2*s.* $5\frac{1}{4}d$; $3605\frac{1}{4}$ at 2*s.* $7\frac{1}{2}d$; $7642\frac{3}{4}$ at 2*s.* $6\frac{3}{4}d$; $8096\frac{1}{2}$ at 2*s.* $4\frac{1}{4}d$; $3095\frac{1}{4}$ at 2*s.* $5\frac{3}{4}d$; $8017\frac{3}{4}$ at 2*s.* $7\frac{1}{4}d$.

(225) Required the value of $9567\frac{1}{4}$ at 2*s.* $8\frac{1}{4}d$; $7653\frac{1}{2}$ at 2*s.* $10\frac{1}{2}d$; $9730\frac{3}{4}$ at 2*s.* $8\frac{3}{4}d$; $8576\frac{1}{4}$ at 2*s.* $9\frac{1}{2}d$; $9673\frac{3}{4}$ at 2*s.* $11\frac{1}{2}d$; $1705\frac{1}{2}$ at 2*s.* $10\frac{3}{4}d$.

226) What will be the value of $2976\frac{1}{4}$ at 2*s.* 11*d*; $6279\frac{1}{2}$ at 2*s.* $10\frac{1}{4}d$; $9297\frac{3}{4}$ at 2*s.* $8\frac{1}{2}d$; $1756\frac{1}{2}$ at 2*s.* $9\frac{3}{4}d$; $7165\frac{1}{4}$ at 2*s.* $11\frac{3}{4}d$; $8432\frac{3}{4}$ at 2*s.* $7\frac{3}{4}d$*?*

(227) Find the value of $5967\frac{1}{2}$ at 3*s.* $0\frac{1}{4}d$; $9576\frac{3}{4}$ at 3*s.* 1*d*; $7823\frac{1}{4}$ at 3*s.* $0\frac{1}{2}d$; $8564\frac{1}{2}$ at 3*s.* $0\frac{3}{4}d$; $9765\frac{1}{4}$ at 3*s.* $3\frac{1}{2}d$; $7867\frac{1}{2}$ at 3*s.* $2\frac{1}{4}d$.

(228) Find the value of $3965\frac{1}{4}$ at 3*s.* 3*d*; $4056\frac{1}{2}$ at 3*s.* $3\frac{1}{2}d$; $4060\frac{3}{4}$ at 3*s.* $4\frac{1}{4}d$; $9276\frac{1}{2}$ at 3*s.* $5\frac{3}{4}d$; $7654\frac{1}{2}$ at 3*s.* $6\frac{1}{2}d$; $8057\frac{3}{4}$ at 3*s.* $6\frac{3}{4}d$.

(229) Required the value of $9765\frac{1}{2}$ at 3*s.* $2\frac{3}{4}d$; $7576\frac{1}{4}$ at 3*s.* 3*d*; $8453\frac{3}{4}$ at 3*s.* $3\frac{3}{4}d$; $4581\frac{1}{2}$ at 3*s.* $3\frac{1}{2}d$; $6589\frac{1}{4}$ at 3*s.* $3\frac{1}{4}d$; $9658\frac{1}{2}$ at 3*s.* $4\frac{1}{2}d$.

(230) What will be the value of $9673\frac{3}{4}$ at 3*s.* $4\frac{1}{4}d$; $8762\frac{1}{2}$ at 3*s.* $4\frac{3}{4}d$; $1752\frac{1}{4}$ at 3*s.* $4\frac{1}{2}d$; $9736\frac{1}{2}$ at 3*s.* $5\frac{3}{4}d$; $7963\frac{1}{4}$ at 3*s.* $5\frac{1}{4}d$; $8363\frac{3}{4}$ at 3*s.* $5\frac{1}{2}d$*?*

(231) Find the value of $9105\frac{1}{2}$ at 3*s.* 6*d*; $8561\frac{1}{4}$ at 3*s.* $6\frac{1}{4}d$; $9736\frac{3}{4}$ at 3*s.* $7\frac{1}{2}d$; $7964\frac{1}{2}$ at 3*s.* $8\frac{3}{4}d$; $9476\frac{3}{4}$ at 3*s.* $10\frac{3}{4}d$; $6749\frac{1}{2}$ at 3*s.* $11\frac{1}{4}d$.

(232) Required the value of $7694\frac{1}{2}$ at 4*s.* $0\frac{1}{4}d$; $8576\frac{1}{4}$ at 4*s.* $3\frac{3}{4}d$; $9654\frac{3}{4}$ at 4*s.* $1\frac{1}{2}d$; $1099\frac{1}{2}$ at 4*s.* $0\frac{1}{2}d$; $9077\frac{3}{4}$ at 4*s.* $1\frac{3}{4}d$; $7569\frac{1}{4}$ at 4*s.* $2\frac{3}{4}d$.

(233) Find the value of $5464\frac{1}{2}$ at 4*s.* $4\frac{3}{4}d$; $5694\frac{1}{4}$ at 4*s.* $4\frac{1}{2}d$; $7963\frac{3}{4}$ at 4*s.* $3\frac{3}{4}d$; $6504\frac{3}{4}$ at 4*s.* $4\frac{3}{4}d$; $5067\frac{1}{2}$ at 4*s.* $5\frac{1}{2}d$; $8693\frac{1}{4}$ at 4*s.* $3\frac{1}{2}d$.

(234) What will be the value of $7963\frac{5}{8}$ at 4*s.* $9\frac{1}{4}d$; $8042\frac{7}{8}$ at 4*s.* $11\frac{1}{2}d$; $9036\frac{2}{3}$ at 4*s.* $8\frac{1}{2}d$; $6748\frac{4}{5}$ at 5*s.* $3\frac{3}{4}d$; $9678\frac{2}{5}$ at 5*s.* $7\frac{1}{4}d$; $8765\frac{5}{7}$ at 5*s.* $10\frac{1}{2}d$*?*

(235) What is the value of $7634\frac{1}{2}$ at 6*s.* $1\frac{1}{2}d$; $9678\frac{1}{4}$ at 6*s.* $8\frac{3}{4}d$;

9102$\frac{1}{2}$ at 6*s.* 11$\frac{1}{4}$*d*; 8457$\frac{3}{4}$ at 6*s.* 5$\frac{3}{4}$*d*; 7548$\frac{1}{2}$ at 6*s.* 10$\frac{1}{4}$*d*; 5875$\frac{3}{4}$ at 6*s.* 4$\frac{1}{4}$*d*?

(236) Required the value of 8736$\frac{1}{4}$ at 7*s.* 1$\frac{1}{2}$*d*; 9756$\frac{1}{2}$ at 7*s.* 7$\frac{1}{4}$*d*; 7965$\frac{3}{4}$ at 7*s.* 11$\frac{3}{4}$*d*; 9675$\frac{1}{4}$ at 7*s.* 8$\frac{1}{2}$*d*; 8354$\frac{1}{2}$ at 7*s.* 6$\frac{1}{4}$*d*; 9001$\frac{3}{4}$ at 7*s.* 9$\frac{3}{4}$*d*.

(237) Find the value of 5764$\frac{3}{8}$ at 8*s.* 5$\frac{1}{2}$*d*; 7654$\frac{4}{5}$ at 8*s.* 9$\frac{3}{4}$*d*; 9605$\frac{2}{5}$ at 8*s.* 7$\frac{1}{4}$*d*; 8065$\frac{4}{7}$ at 8*s.* 11$\frac{3}{4}$*d*; 9123$\frac{5}{8}$ at 8*s.* 4$\frac{1}{2}$*d*; 6752$\frac{5}{9}$ at 8*s.* 3$\frac{1}{4}$*d*.

(238) What is the value of 5478 at $\frac{1}{2}$*d*; 6905 at 3$\frac{1}{4}$*d*; 7908 at 2*l.* 16*s.* 6*d*; 6817 at 17*s.* 10$\frac{1}{2}$*d*; 6345 at 3*s.* 8$\frac{3}{4}$*d*; 9706 at 11$\frac{1}{4}$*d*?

(239) Find the value of 5605 at 5*l.* 19*s.* 8*d*; 2869 at 10*s.* 10$\frac{1}{2}$*d*; 7523 at 7$\frac{3}{4}$*d*; 6225 at $\frac{3}{4}$*d*; 9653 at 18*s.* 7*d*; 6021 at 5$\frac{1}{2}$*d*.

(240) What is the value of 6094$\frac{1}{2}$ at 3*l.* 19*s.* 6$\frac{1}{2}$*d*; 7123$\frac{3}{4}$ at 5*l.* 14*s.* 7$\frac{1}{4}$*d*; 4132$\frac{1}{4}$ at 7*l.* 13*s.* 10$\frac{3}{4}$*d*; 3506$\frac{1}{2}$ at 9*l.* 17*s.* 11$\frac{1}{2}$*d*; 5160$\frac{1}{4}$ at 13*l.* 19*s.* 5$\frac{1}{4}$*d*; 7579$\frac{3}{4}$ at 19*l.* 16*s.* 9$\frac{1}{2}$*d*?

(241) Add $\frac{3}{4}$ of 10, $\frac{1}{2}$ of 13, and $\frac{1}{3}$ of 11.

(242) Find the difference of 10, and $\frac{10}{11}$ of 10.

(243) Multiply the sum of 3$\frac{3}{7}$ and $\frac{7}{9}$ by their difference.

(244) Divide the sum of 3$\frac{2}{3}$ and $\frac{3}{4}$ by the difference of 3$\frac{2}{3}$ and $\frac{3}{4}$.

(245) If 12 pieces of cloth cost 100*l.* 10*s.* 6*d*, at 5*s.* 6$\frac{3}{4}$*d*. *per ell* Flemish, how many ells English were there in a piece?

(246) If the penny loaf weighs 12$\frac{2}{3}$*oz.* when the bushel of wheat sells for 5*s*, what is the bushel worth when the penny loaf weighs 8$\frac{3}{4}$ *ounces*?

(247) How many yards of cloth, at 8*s.* 6$\frac{1}{4}$*d*. *per yard*, must be given for 26$\frac{1}{3}$ yards, at 5*s.* 7$\frac{3}{4}$*d*?

(248) If 6$\frac{5}{8}$ yards of cloth nine-eight wide will make a cloak, how much $\frac{3}{4}$ yard will line it?

(249) What must be paid for the carriage of 17$\frac{3}{4}$*cwt.* 7$\frac{1}{2}$ miles, when 5$\frac{1}{4}$*cwt.* is carried 20 miles for 16*s.* 4*d*?

(250) If a man travel 273 miles in 6$\frac{2}{3}$ days, of 12 hours long, in how many days, of 9$\frac{1}{3}$ hours each, may he travel 132 miles?

(251) What number must be subtracted from 136$\frac{7}{8}$ to leave 75$\frac{9}{13}$ for the remainder?

(252) What must 126$\frac{8}{11}$ be divided by, that the quotient may be 20$\frac{2}{3}$?

(253) What must be added to 376$\frac{5}{6}$, that the sum may be 1204$\frac{5}{8}$?

(254) What must I subtract 354$\frac{2}{7}$ from to leave 127$\frac{1}{3}$?

(255) Required the sum and difference of $\frac{55}{94}$ and 16$\frac{5}{9}$.

divid. *divis.*

(256) Required the product and quotient of $\frac{492}{1648}$ and $\frac{284}{368}$.

(257) What must be multiplied by 36$\frac{4}{16}$ to give 1516$\frac{16}{17}$ for the product?

(258) What must I multiply $71\frac{1}{2}$ by, to give $6054\frac{21}{34}$ in the product?

(259) Required the product of $2\frac{1}{2}$, $4\frac{1}{2}$, $\frac{5}{9}$, $\frac{4}{5}$, 10, and $\frac{2}{3}$ of $\frac{3}{4}$.

(260) Required the product of $\frac{1}{2}$, $\frac{1}{3}$, and 56427.

(261) Required the product of $646124\frac{1}{2}$, and $64\frac{1}{2}$.

(262) Required the product of 8320 $\frac{1}{111}$ and $\frac{37}{297911}$.

divid. *divis.*

(263) Required the quotient of $24710\frac{1}{2}$ by $37065\frac{3}{4}$.

(264) Required the quotient of $9404\frac{1}{2}$ by $\frac{1}{6}$.

(265) Required the quotient of 24012 and $421\frac{5}{19}$.

(266) Required the quotient of 300 by $\frac{3}{4}$ of 30.

(267) Required the quotient of $\frac{4}{5}$ of $\frac{5}{6}$, and $\frac{2}{3}$ of $\frac{3}{4}$.

(268) Required the quotient of $\frac{4}{7}$ of 9, and of $\frac{3}{7}$ of 9.

(269) Required the quotient of $10000\frac{2}{3}$ and $\frac{2}{3}$.

(270) Required the quotient of $4164217\frac{7}{48}$ and 7.

(271) Required the difference of $1000\frac{3}{5}$ and $100\frac{14}{15}$.

(272) Required the difference of $10\frac{1}{2}$ and $\frac{5}{6}$ of $10\frac{1}{2}$.

(273) Required the difference of $\frac{2}{3}$ of 8, and $\frac{2}{3}$ of 7.

(274) Required the difference of $\frac{3}{5}$ of $\frac{10}{11}$, and $\frac{2}{5}$ of $\frac{10}{11}$.

(275) Add $\frac{7}{9}$ of a shilling to $\frac{1}{24}$ of a pound.

(276) What is the compound interest of 500*l.* for 4 years, at 5*l. per cent?*

(277) Reduce $\frac{7}{8}$ of a noble to the fraction of a crown.

(278) Three persons trade together; A advanced $\frac{1}{4}$ of the stock, B $\frac{3}{5}$ of what A put in, and C the rest; they gained 276*l.* 8*s.* 6*d*, what was each man's share of the gain?

(279) What will be the compound interest of 863*l.* 10*s.* for $4\frac{1}{2}$ years, at 5*l. per cent?*

(280) Add $\frac{7}{8}$ of an angel to $\frac{5}{6}$ of a crown.

(281) Add $\frac{4}{5}$ of a pound to $\frac{3}{7}$ of a guinea.

(282) Add $\frac{3}{5}$ of an ell English to $\frac{2}{3}$ of a yard.

(283) Add $\frac{5}{6}$ of an ell French to $\frac{3}{5}$ of an ell Flemish.

(284) If $3\frac{1}{2}l.$ be the wages of 13 men for $7\frac{1}{2}$ days, what will be the wages of 20 men for $15\frac{1}{3}$ days?

(285) A certain person left $6000\frac{1}{2}$ guineas, to be divided into shares, A, B, C, D, E; of which A was to have $\frac{1}{2}$, B $\frac{1}{3}$, C $\frac{1}{4}$, D $\frac{1}{5}$, E $\frac{1}{6}$; required the share of each.

(286) Multiply 3*l.* 19*s.* $11\frac{3}{4}d.$ by 3*l.* 19*s.* $11\frac{3}{4}d.$

(287) If 248 men, in $5\frac{1}{2}$ days, of 11 hours each, dig a trench of 7 degrees of hardness, $232\frac{1}{2}$ yards long, $3\frac{2}{3}$ wide, and $2\frac{1}{3}$ deep, in how many days, of 9 hours long, will 24 men dig a trench of 4 degrees of hardness, $337\frac{1}{2}$ yards long, $5\frac{3}{5}$ wide, and $3\frac{1}{2}$ deep?

(288) If $3\frac{1}{2}$ times $3\frac{1}{2}lb$, cost $1\frac{1}{2}$ times $1\frac{1}{2}l$, what will $\frac{1}{4}$ of $12\frac{1}{4}lb.$ and $\frac{1}{3}$ of $1lb.$ cost?

(289) If when a bushel of wheat is sold for $4\frac{2}{3}s$, the penny loaf weighs $5\frac{2}{3}oz$, what must it weigh when the bushel is sold for $6\frac{3}{10}s$?

(290) Required the product of $\frac{3}{7}$ of a week, and $\frac{1}{9}$ of 4 days.

(291) Find the commission on 507*l.* 12*s.* 8*d*, at $2\frac{1}{4}l$; 713*l.* 6*s.* 8*d*, at $2\frac{1}{2}l$; 473*l.* 15*s.* 7*d*, at $2\frac{3}{4}l$; 837*l.* 0*s.* 7*d*, at $3\frac{1}{2}l$. *per cent.*

(292) What is the amount of 317*l.* 16*s.* for 5 years 9 months, at $3\frac{1}{2}l$. *per cent*, simple interest?

(293) At 5*l.* *per cent*, *per annum*, in what time will 871*l.* gain 39*l.* 18*s.* 5*d*?

(294) Find the amount of 874*l.* 16*s.* 8*d.* for 13 years 11 months, at $4\frac{3}{8}l$. *per cent*, simple interest.

(295) What is the compound interest on 560*l.* for 3 years, at 5*l.* *per cent*?

(296) What will be the commission on 731*l.* 18*s.* 9*d*, at $\frac{1}{4}l$. *per cent*; 871*l.* 16*s.* 7*d*, at $\frac{1}{2}l$. *per cent*; 873*l.* 14*s.* 3*d*, at $\frac{3}{4}l$. *per cent*; and 912*l.* 18*s.* 9*d*, at 1*l.* *per cent*?

(297) Required the commission on 712*l.* 16*s.* 5*d*, at $1\frac{1}{2}l$. *per cent*; 384*l.* 12*s.* 8*d*, at $1\frac{1}{4}l$; 879*l.* 15*s.* 2*d*, at $1\frac{3}{4}l$; and 917*l.* 6*s.* 8*d*, at 2*l.* *per cent.*

(298) Divide 2762*l.* 8*s.* among three persons, A $\frac{1}{2}$, B $\frac{5}{16}$, C $\frac{3}{16}$.

(299) Divide 11372*l.* 14*s.* among four persons, A $\frac{5}{12}$, B $\frac{1}{4}$, C $\frac{5}{24}$, D $\frac{3}{24}$.

(300) Four persons purchase an estate containing 1144*a.* 2*r.* 21*p*, at 75*l.* 15*s.* *per acre*; what was the purchase money, what quantitity of land had each, and what sum did each pay, suppose John to have $\frac{1}{2}$, James $\frac{1}{3}$, Charles $\frac{1}{4}$, and Thomas $\frac{1}{5}$?

MISCELLANEOUS QUESTIONS.

(1) What is the thirty-fourth part of seventeen times 48?

(2) What is the difference between $\frac{2}{3}$ of $\frac{5}{9}$, and $\frac{1}{2}$ of $\frac{2}{3}$ of $1\frac{4}{5}$?

(3) What number divided by 56, will give $13\frac{1}{2}$ in the quotient?

(4) If $1\frac{1}{2}$ yard of kersey cost 3*s*, how many yards of the same may I have for a guinea?

(5) What will $46\frac{3}{4}$ yards come to at 1*l.* 17*s.* 9*d.* *per yard*?

(6) How far will a man travel in 46 days, who travels 240 miles in 8 days?

(7) If 6 men do a piece of work in 8 days, how many men would do the same in 3 days?

(8) How many yards of flannel, at 15*d.* *per yard*, will purchase 6 dozen of wine, at 1*s.* $8\frac{1}{2}d$. *per bottle*?

(9) Sold cloth at 7*s.* 4*d.* *per yard*, and gained 12*l.* *per cent*, what would have been my gain *per cent* if I had sold the same at 1*s.* *per yard*?

(10) If 2 men do a piece of work in 8 days, which one of them would perform in 12 days, in what time would the other do it himself?

(11) Required the value of $\frac{4}{5}$ of $\frac{7}{8}$ of 13*s.* 4*d.*

(12) What is the value of $\frac{2}{3}$ of $\frac{7}{6}$ of 16 feet?

(13) If $\frac{2}{7}$ of a noble buy $\frac{5}{9}$ of an ell English, how many yards will $7\frac{3}{4}$ guineas buy?

(14) Required the value of 125*oz.* 17*dwts.* 23*grs.* of silver, at 5*s.* 11*d. per oz.*

(15) A grocer bought 96*lb.* of tea for 37*l*, how must he sell it *per ounce* to gain 12*l.* at laying out 80*l?*

(16) A person after spending two-thirds of his money at one place, and half the remainder at another, had 32 guineas left, how much had he at first?

(17) Sold a quantity of tobacco for 20*l*, and by so doing lost 20*l. per cent*, whereas I ought to have gained as much *per cent* as the tobacco cost me; what was my loss in point of trade?

(18) A, B, and C, bought a piece of land, which they paid for in such a manner, that as oft as A paid 8*l*, B paid 6*l*, and as oft as A paid 5*l*, C paid 7*l*; required each person's share of the yearly rent, which is 160*l.*

(19) A person left by will 200*l.* to his two sons, to be paid in the following manner, *viz.* to the oldest 1*l.* for the first month, 3*l.* the second month, 5*l.* the third, &c. in arithmetical progression; but the younger was to receive 10*l. per month* till the whole was paid; how much was each son's share, and how long will they be in receiving it?

(20) The height, breadth, and length of a room are 4, 6, and 9 yards respectively; what is the longest right line that can be taken within that room?

(21) A plumb or weight of 20*lbs.* hung at 30 inches distance from the fulcrum of a steel-yard, will counterpoise a cask of red wine suspended at 2 inches from the fulcrum on the other side; how many gallons of wine does the cask contain, supposing a gallon to weigh $7\frac{1}{2}$*lb*, and the wood to weigh 40*lb?*

Note.—The weights to keep a lever, or steel-yard, in equilibrio, will be inversely as their distances from the fulcrum.

(22) Bought 4768 yards of cloth for 1192*l*, which I sold at 7*s.* 6*d. per ell English;* what did I gain thereby, and what *per cent?*

(23) A person borrowed 400*l.* and agreed to pay 50*l.* yearly for 13 years; whether will he gain or lose thereby, reckoning compound interest, at 5*l. per cent, per annum?*

(24) A person bought 300 eggs at 2 for a penny, and 300 at 3 for a penny, and afterwards sold the whole at 5 for 2*d;* whether did he gain or lose, and how much?

(25) A person bought 1000 apples at 5 for a penny, and sold

one-half thereof at 4 for a penny, and the other half at 6 for a penny, what did he gain or lose thereby?

(26) Sold hops at 6*l.* 15*s.* *per cwt*, and gained 20*l.* *per cent*, what would have been the gain *per cent*, if they had been sold for 7*l.* 5*s.* *per cwt?*

(27) A person laid out 60*l.* in cloth at 5*s.* *per yard*, and 60*l.* in another parcel at 6*s.* *per yard*, all of which he sold at 5*s.* 6*d.* *per yard;* what did he gain or lose thereby, and what *per cent?*

(28) If I take half of a number and half the remainder continually, what will be the series and the sum thereof ad infinitum?

(29) If I take two-thirds of any given number, and two-thirds of the remainder continually, what will be the form of the series, and the sum thereof ad infinitum?

(30) Take three-fourths of any number, and three-fourths of the remainder continually, and show the form of the series and the method of finding the sum thereof ad infinitum.

(31) If I take four-fourths of any number, and four-fifths of the remainder continually, what is the form of the series and the sum thereof?

(32) Bought a horse and sold him again for 50*l*, and gained one-fourth of what it cost me; what was the cost and gain?

(33) Sold a horse for 30*l.* and gained 20*l.* *per cent*, what did he cost me?

(34) What number is that if two-sevenths thereof be multiplied by 3, the square root of two-ninths of the product will be 4?

(35) The longest right line that can be taken in a room whose length, breadth, and height are all equal, is 7 yards; what is the length, breadth, and height of that room?

(36) A gentleman has an estate with forty cottages thereon, which he values in the following manner—the first at 1*s*, the second at 2*s*, the third at 4*s*, and so on doubling through the whole; what does he value the last at, and what would be the purchase of the whole?

(37) If the diameter of a circular bushel be 18·5 inches, what must be the diameter of a two bushel measure, of the same depth with the former?

(38) If a ship of 300 tons burden be 40 feet long at the keel, what length of keel must a ship of 800 tons have?

(39) A ladder standing upright against a wall just reaches the top thereof, but standing 12 feet from the bottom will reach to within 6 feet of the top; what is the height of the wall, or length of the ladder?

(40) If a stone be $3\frac{1}{2}$ seconds in falling from the top to the bottom of a coal-pit, what is the depth of the pit?

(41) Sound is said to fly uniformly at the rate of 1142 feet *per second;* now if seven seconds elapse betwixt seeing the fire and hearing the report of a gun, at what distance is the spectator from the gun?

(42) How far distant is thunder, when $9\frac{3}{4}$ seconds elapse between seeing the flash of lightning and hearing the thunder?

(43) What must be the diameter of a circular meadow to contain just an acre, or 4840 square yards?

(44) Suppose a wall be 30 feet high, and a ladder 30 feet long stand 9 feet from the foot of the wall, how far will the top of the ladder be from reaching the top of the wall?

(45) There are 2 cannon balls, one of which weighs 28*lbs.* and the other 9*lbs*, the less ball is 5 inches in diameter; what is the diameter of the greater?

(46) If $\frac{2}{3}$ of 7 be made 4, what will $\frac{1}{6}$ of 16 be made?

(47) Write six-sevenths so as to make 78.

(48) Three men, A, B, and C, have each a certain sum of money; now A and B's together is 60*l*, B and C's 84*l*, A and C's 72*l*; how much had each?

(49) How long must an annuity of 25*l*. 10*s*. *per annum* be continued to discharge a debt of 250*l*, allowing compound interest at 5*l*. *per cent?*

(50) Add, by the rules in fractions, 71*l*. 7*s*. 6*d*; 37*l*. 5*s*; 6*l*. 12*s*. 6*d*; 87*l*. 13*s*. 4*d*; 98*l*. 15*s*; 18*l*. 17*s*. 6*d*; 68*l*. 3*s*. 4*d*; 91*l*. 2*s*. 6*d*; 105*l*. 1*s*. 8*d*.

(51) Add $\frac{5}{6}$ of an ell French to $\frac{2}{3}$ of an ell Flemish.

(52) Add $\frac{11}{12}$ of a moidore to $\frac{3}{4}$ of 100*l*.

(53) Bought 25 pieces of Holland, each containing 25 ells English for 300 guineas, what is it *per yard?*

(54) What is the difference between 6 dozen dozen, and half a dozen dozen?

(55) Multiply 4*l*. 19*s*. $9\frac{1}{4}$*d*. by $23\frac{4}{9}$.

(56) Divide ·0020 by ·0100; and 1· by ·7863.

(57) Divide $\frac{3}{4}$ of $\frac{5}{8}$ by ·0003; and ·023 by ·5.

(58) Divide $\frac{1}{2}$ of 15*l*. 16*s*. by $\frac{3}{4}$ farthings.

(59) Add $\frac{1}{5}$ of $\frac{3}{4}$ years, $\frac{3}{8}$ of $\frac{5}{9}$ days, and $\frac{7}{8}$ of $\frac{3}{5}$ of $19\frac{1}{2}$ hours.

(60) What number is that to which, if $\frac{3}{10}$ of $\frac{18}{7}$ of $\frac{141}{213}$ be added, the sum will be one?

THE END.

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